MARCH 1952

APPLIED HYDRAULICS

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THE MAGAZINE OF FLUID POWER TRANSMISSION

INCLUDING AIR CONTROLS AND AIR CIRCUIT DESIGN; ELECTRICAL CONTROLS

CIRCUIT DESIGN FOR 1000 TON HYDRAULIC RAM Page 54

ELECTRICAL INTERLOCKS SIMPLIFY HYDRAULIC CONTROL Page 57

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Listed on page 2 you'll find 14 articles and 8 regular departments which feature application and design ideas for fluid power equipment

FLEXIBLE HOSE LINES

WITH DETACHABLE, REUSABLE FITTINGS

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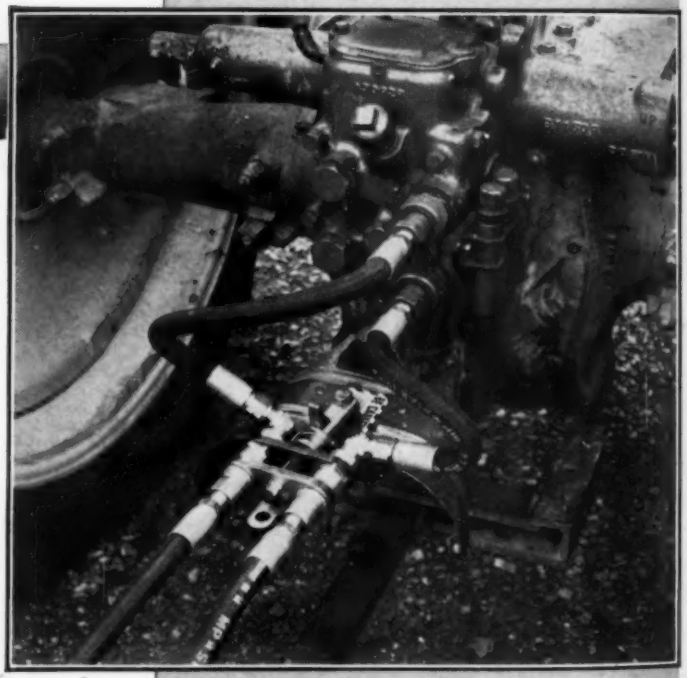
ON FARM EQUIPMENT



Save time, save money and reduce inventory by putting the "Aeroquip Idea" to work for you. With Aeroquip you make your own flexible hose assemblies by cutting bulk hose to desired lengths and attaching Aeroquip Reusable Fittings. Assembly can be accomplished quickly and easily right on the job. No special tools are required. No training is needed. Aeroquip high quality Flexible Hose Lines improve performance and reduce maintenance. They eliminate leaks due to vibration and operate dependably at extremely high or low temperatures. They are widely used for hydraulic fluid, water, air, lubricating oils, gas and Diesel fuels and many other fluids.

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Aeroquip Flexible Hose Assemblies are pictured here connecting the tractor hydraulic system to the pull-behind implement. Connecting the hose lines is the Aeroquip "Breakaway" Coupling which eliminates the breaking of hose lines whenever the implement breaks away from the tractor.

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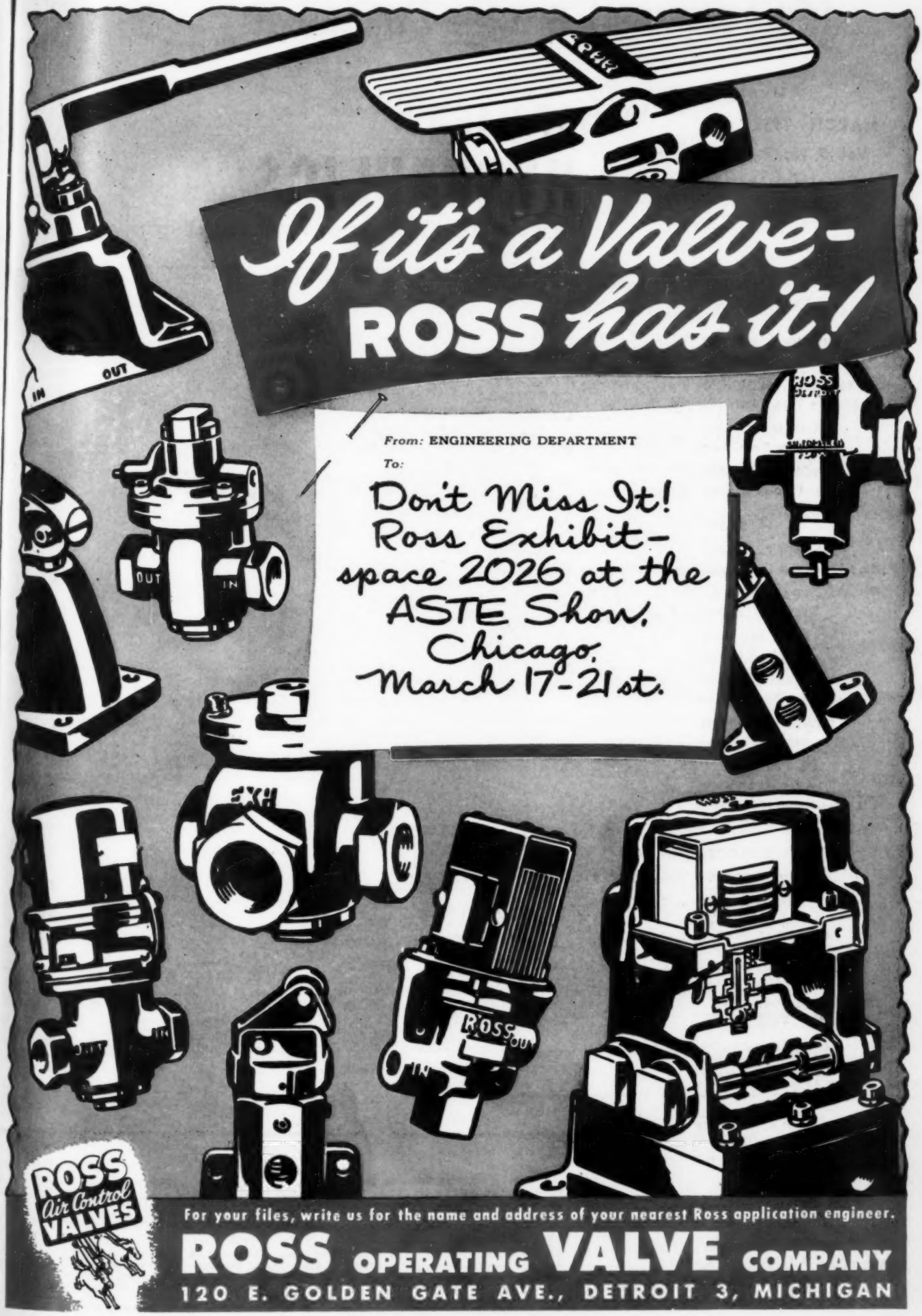

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MARCH 1952
Vol. 5, No. 3

APPLIED HYDRAULICS

PNEUMATICS - HYDRAULICS - ELECTRICAL CONTROLS

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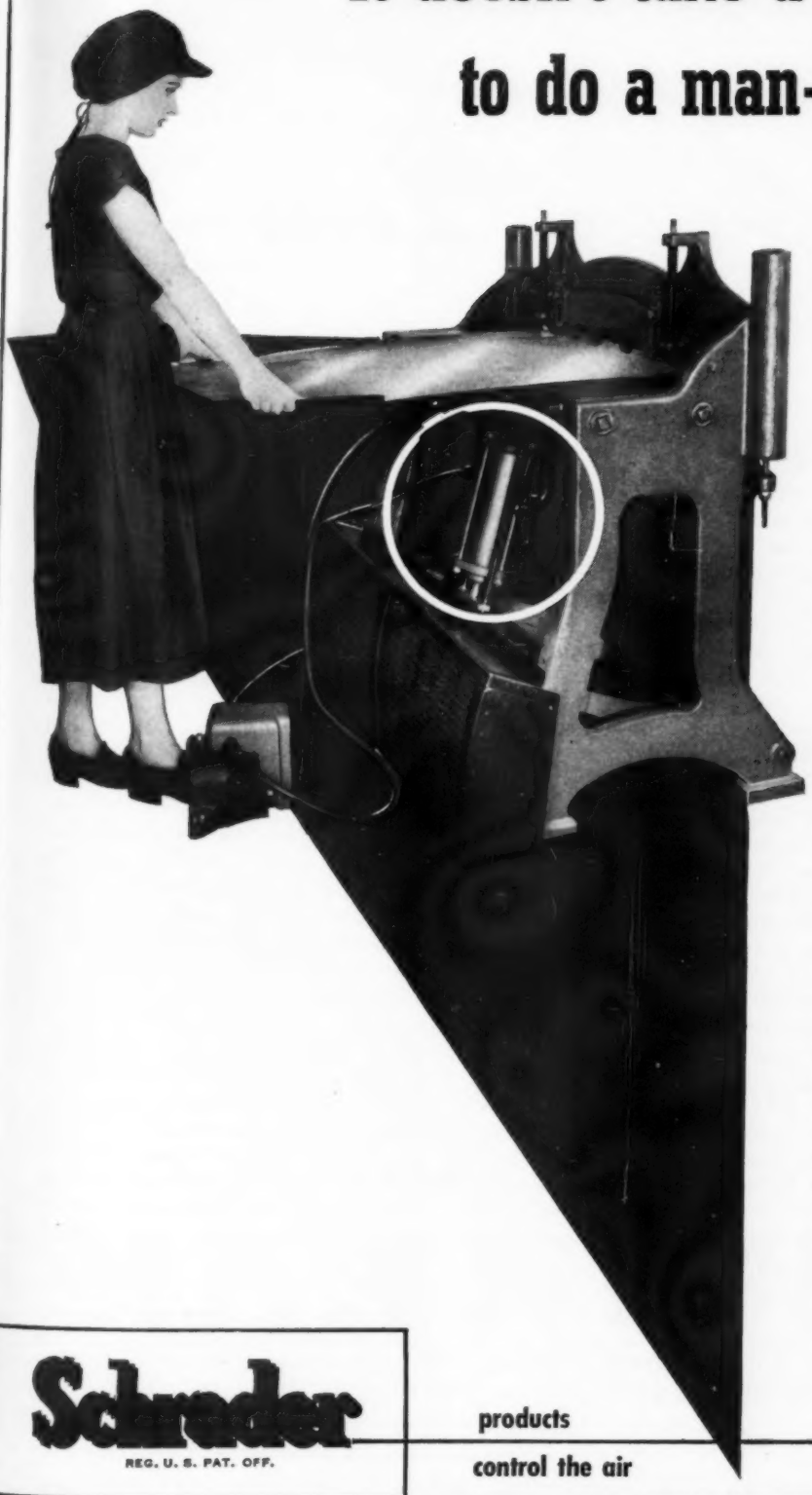
It doesn't take a heavyweight to do a man-sized job



Before these shears were shifted to air operation the entire weight of a man was required on the foot treadle to cut the sheet metal.

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Fluid Power Lines

High Tonnage Machines . . . We've prefaced this month's lead article "Design of a High Horsepower Circuit for Aluminum Extrusion" with a short survey of hydraulic power applications in large presses. New structural requirements for aircraft are bringing about the design of hydraulic forging and extrusion presses which have a larger capacity than present equipment by many thousands of tons. While hydraulics has long been used as a power source for "big push" jobs, circuit design for large installations presents many new problems of control and construction. In the next three years we'll see new 50,000 ton forging and 25,000 ton extrusion presses being put to work making parts which previously have been impossible to produce without fabricating.

Oil Power and Paul Bunyan . . . R. E. Davis' article on drives used in sawmills describes a severe load application. The lumbering industry in the Northwest is finding that oil. properly applied, can speed the handling and sawing of their largest logs. Sawing 18 foot boards from 20,000 pound logs is accomplished with fine control when feeding carriage mounted logs through the saws with oil power.

Electrical Interlocks . . . Wherever in-plant production machines are designed using air or oil power, the design is a result of close co-ordination between the hydraulic and electrical design men, the machine builder and electrician. In some plants, that we've visited, electrical and hydraulic disign is worked out by the same man. In others, the machine designer lays out the hydraulic circuit and then calls on an electrical design man to work out the control panel with its necessary timers, relays and limit switches to control the solenoid valves.

M. W. Morrison's article describing the electrical and hydraulic design of a forming machine in the Ternstedt Division of General Motors Corporation at Columbus, shows how this plant builds in-plant production tooling.

Satisfied with Symbols? . . . Standardization of drawing symbols always creates debate. There are the old-timers who have a system which has worked well for themselves for many years and therefore they hesitate to change. Then there are the designers who feel that the present symbols can stand improvement. This is not a new problem to electrical men. It is with hydraulic designers. J.I.C. hydraulic symbols have only been around for three years. When they were established, a pattern was set up from which symbols could be derived. We believe the pattern is a good one. Today, drawings are simpler and more easily understood. This month we've printed one reader's suggestions for what he believes will be improved use of symbols. He asks. "How do others feel about symbols?"

Mechanical Refrigeration and Oil Care . . . In A. R. Morse's article "How to Prevent Overheating of Hydraulic Systems" the use of a mechanical refrigeration unit is described. On plastic molding equipment where cooling dies is more of a problem than cooling hydraulic oil, the installation of refrigerating units is a practical solution. It can then also be applied to maintain proper oil temperature. The use of oil coolers controlled by automatic temperature control valves will economically handle most oil cooling jobs. It's the few extreme applications where machines operate continuously at peak capacity that it will pay you to consider refrigeration.

How Much Air? . . . Ralph E. Middleton, APPLIED HYDRAULICS' aviation advisory editor has worked out a chart which will speed the determination of capacity and requirements of a pneumatic storage system. Aircraft pneumatic systems where temperatures range from +165 to —65F require time consuming calculations to determine capacities. The chart is a big step toward simplifying calculations that involve air expansion which does not follow the perfect gas laws.

Coming . . . One of the largest machine tool installations in this country will be described next month. Both air and oil power are used on a special multi-circuit grinder being used on the Walker Bulldog tank production line. The problem of preventing shock as hydraulic power reciprocates each of the 10 five ton grinder heads is solved by careful circuit design . . . Armament requirements also have resulted in the use of a special hot forming process for the production of rocket bodies. A differential hydraulic circuit to be included next month provides adjustable speeds for a variety of forming applications . . . In April, a series of articles on "Good Practices in Hydraulic Design and Construction" will get underway. Written by a machine builder, the series will include many practical suggestions for men in design, maintenance and production.

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Complete hydraulic cylinder catalog, illustrating design features, styles, dimensions. Also bore tables, engineering data and formulae.

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Product Index

Here's a convenient guide for finding manufacturers of components used in the fluid power field. Page numbers for products advertised in this issue are given. You can get complete information on any advertised components by using the Reader Service Card which you'll find between pages 32 and 33.

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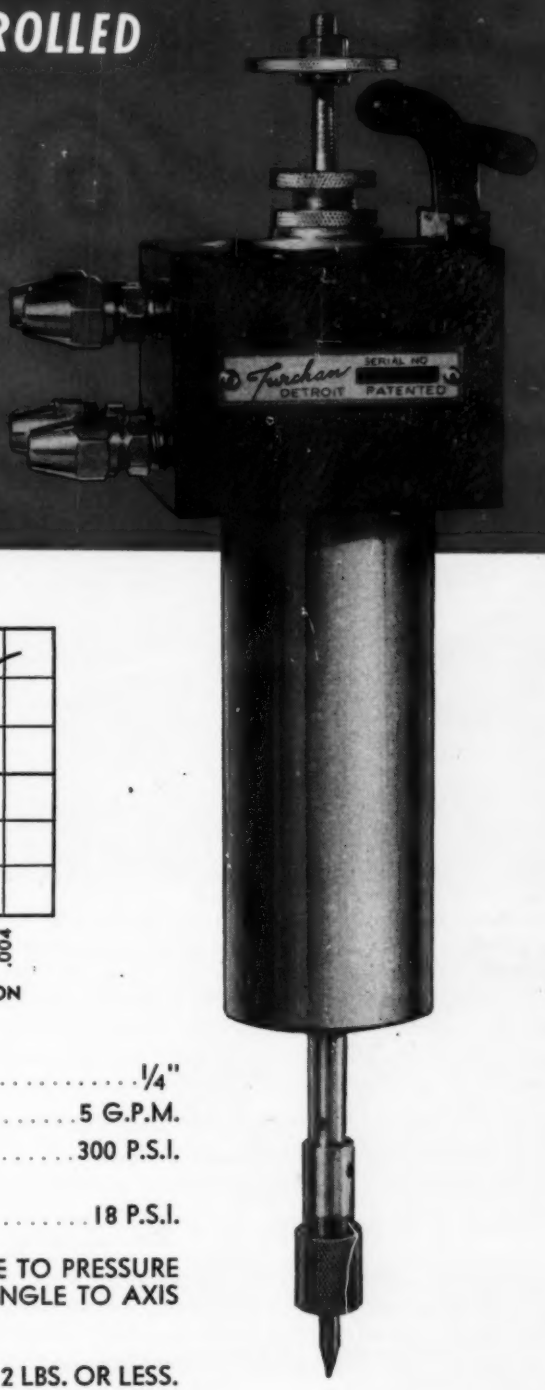

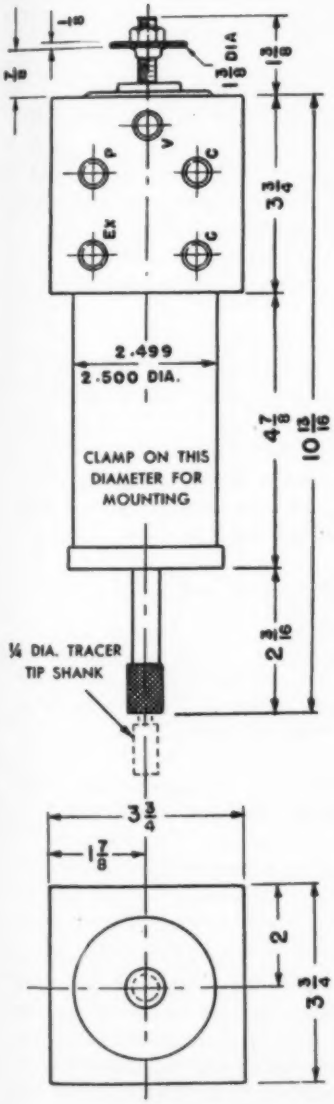

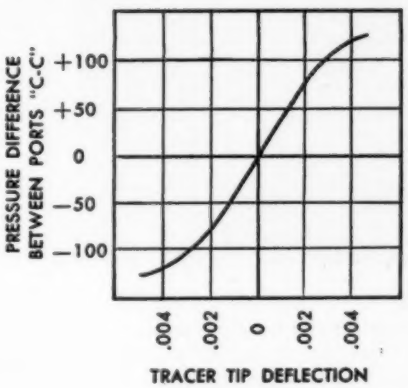

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LITERATURE AND SERVICES OFFERED IN THIS MONTH'S ADS

HOSE ASSEMBLIES Resistoflex Corporation has prepared specification sheets for their line of hose assemblies for hydraulic systems.

Circle 88 on Reader Service Card

ROTARY AIR CYLINDERS Bulletin PO-8, prepared by The Cushman Company, describes their simple, rugged, iron body, rotating air cylinders.

Circle 24 on Reader Service Card

PACKINGS FOR AIR AND OIL SYSTEMS To help speed your packing deliveries, Periflex, Inc. has prepared a folder which lists hundreds of molds carried in stock.

Circle 79 on Reader Service Card

HYDRAULIC CYLINDERS Cartridge type packing glands are featured in the design of Petch air and hydraulic cylinders which are described in available engineering data. Complete mounting and size specification are provided.

Circle 81 on Reader Service Card

TENSION LINKAGES Chain Belt Company's tension linkage bulletin covers typical examples of tension linkage applications, helpful step-by-step data on equipment selection and tables of dimensional data.

Circle 20 on Reader Service Card

REMOTE CONTROL Using a master and slave control unit you can easily operate a power system from a remote, convenient location. Simple positive remote control units are described in a catalog available from Superdraulic Corporation.

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Literature Offered in Ads

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SOLENOIDS For information on this important component in your air and oil control systems ask for bulletin EM-46A which has been prepared by the National Acme Co. Complete standard range of Namco "Stellite" welded solenoids is illustrated and tabulated in the engineering bulletin.

Circle 71 on Reader Service Card

PROTECTING AIR LINES Using a filter, a regulator and lubricator unit is the key to long, safe operation of air powered equipment. M-B Products has prepared literature describing their "sentinel of the air line".

Circle 62 on Reader Service Card

DUAL PURPOSE VANE TYPE PUMP Use it as a pump or motor. Bulletin P-5 gives full details on this unique, dual purpose hydraulic pump motor recently introduced by The Denison Engineering Co.

Circle 26 on Reader Service Card

"O" RINGS Catalog 5100, available from The Parker Appliance Company, lists both standard and special "O" rings for hydraulic service. Dimensional, installation and compound information is included.

Circle 78 on Reader Service Card

VALVE ACTUATORS Operating gate valves with cylinders is described in Bulletin 512 available from Ledeen Mfg. Co.

Circle 57 on Reader Service Card

PRESSURE PLUGS Oil leaks from plugged ports can be eliminated by proper selection of pipe plugs. Standard Pressed Steel Co. offers a folder describing their Dry-Seal pressure plugs.

Circle 102 on Reader Service Card

PRESSURE GAGES Your best trouble shooting tool is a pressure gage. Marsh Instrument Co. offers a catalog describing available gauge styles and ranges.

Circle 63 on Reader Service Card

Continued on next page

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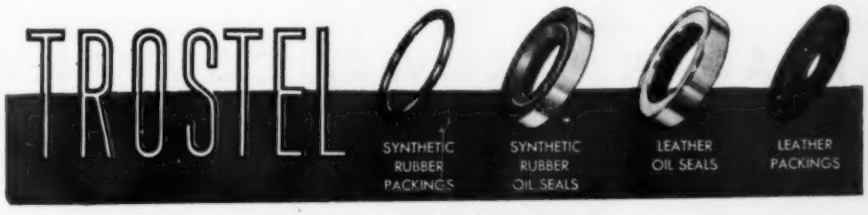

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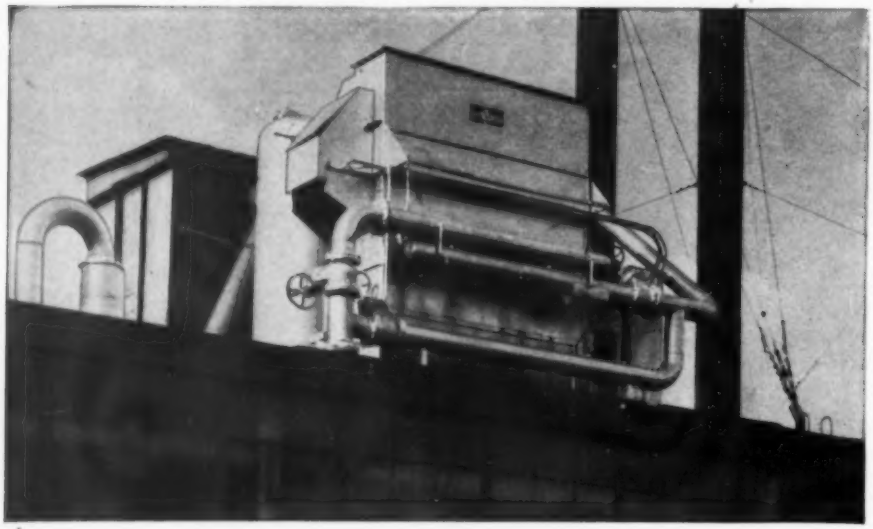

How to Get Drier Compressed Air:

It prevents many troubles and saves much expense

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If you have an air problem or a cooling problem, a Niagara engineer probably has an answer that will improve your process or save you operating or maintenance expense.

Write for Bulletin 98

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Circle 73 on Reader Service Card

SAVING PRODUCTION HOURS WITH AIR Mead Specialties Company has published a suggestion-filled booklet on the use of air powered tooling in production shops.

Circle 65 on Reader Service Card

CUSHIONED AIR CYLINDERS Bulletin 252, prepared by Tomkins-Johnson Company describes their new cushion design for air cylinders which insures positive cushion with automatic valve action for fast return stroke.

Circle 107 on Reader Service Card

VALVES FOR ALL MEDIUMS and types of operation, which show longer leak free service, are outlined in Catalog 1250 published by W. H. Nicholson & Co.

Circle 74 on Reader Service Card

SAVING IN REPAIRS to pneumatic tools and equipment and saving interruption to production. These are some of the advantages of the Aero after cooler which are set forth in Bulletin 98 published by the Niagara Blower Co.

Circle 73 on Reader Service Card

THE ANSWER TO YOUR PROBLEMS may be found in Bulletin H 2. This booklet illustrates piston ring seals which eliminate gap leakage. It is available from the Burd Piston Ring Co.

Circle 17 on Reader Service Card

SEAL BOTH ENDS of a line automatically and instantaneously with new foolproof high pressure 2 way shut off couplings. The Hansen Manufacturing Co. has issued a catalogue giving complete range of types and sizes.

Circle 45 on Reader Service Card

CHOICE OF SIX SIZES of hydraulic pumps, to comply with your specific requirements, is outlined in a complete illustrated bulletin on the 500 Series Hydraulic Pumps, by Brown & Sharpe.

Circle 16 on Reader Service Card

TIME AND TROUBLE SAVING features of a new split-flange clamp, for users of hydraulic hose and piping, are described in literature issued by the Anchor Coupling Co.

Circle 9 on Reader Service Card

ASTE Exposition and Technical Program

THE 20th Annual meeting of the American Society of Tool Engineers will be held in Chicago the week of March 17-21. The ninth biennial Industrial Exposition will be held at the International Amphitheatre; the technical sessions will be held at the Stockyards Inn, adjacent to the Exposition area, at the Palmer House and at the Conrad Hilton Hotel (formerly the Stevens Hotel).

Space reserved for exhibits in the five halls that make up the exhibit area represent a 30 percent increase in floor space over the last previous record meeting in 1950. Units of space reserved indicate that many companies consider the ASTE Industrial Exposition as a "must", in spite of the great pressure for increased production in their own plants. Many industrial organizations have indicated that a maximum number of their technical personnel will attend; there are indications that a number have set up staggered visiting schedules for specialists who want to see specific new equipment or to hear papers of special interest.

Charles E. Wilson To Speak

Technical meetings will be held each morning and early afternoon from Monday through Friday. A panel discussion will end each afternoon session. Evening sessions will be held on Monday, Tuesday and Wednesday, with the annual banquet on Thursday evening. Charles E. Wilson, Director of Defense Mobilization, will be the speaker.

Monday will be Precision Control Day with the panel discussion on "Turning and Forming Tolerances"; Tuesday will be Metal Cutting Day with the panel discussion on "Drilling"; Wednesday will be Materials Forming Day with the panel discussion on "Metal Stamping Dies and Operations"; Thursday will be Grinding and Finishing Day with the panel discussion on "Finish Grind-

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That Prevents Reversal of Flow in ***AIR . . . OIL OR WATER APPLICATIONS***

The Electrol (463FP) Check Valve is ideally suited for heavy-duty service applications — providing air, oil or water control lines with a minimum of pressure drop, and positive sealing against return flow. It has a maximum operating pressure of 5000 P. S. I., with a cracking pressure—in free flow direction—from 2 to 8 P. S. I. Elements are of brass and bronze—and include a patented O-ring check seat. Let us have a blueprint so we can work with you in adapting this Check Valve to meet your specific requirement. Your inquiry will receive prompt attention.

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Parco "O" Rings mean superior sealing action and longer wear whenever and wherever hydraulic equipment is used. The rubber is *specially blended* to meet your individual requirements. Five combinations of synthetic rubber plus natural rubber overcome problems in heat and cold, weathering, flexibility, permeation, resistance to chemicals, solvents and engine oils due to special custom applications.

Requirements for fine tolerances are completely fulfilled. Remember, wherever there's a hydraulic sealing problem in new equipment or maintenance work, the Parco "O" Ring excels. Specify a superior product at no premium to you. All dash numbers of 6227, 6230 and 6290 series for commercial applications or Army-Navy installations to Specifications MIL-P-5516 (6227 and 6230) and MIL-G-5510 (6290) are available from stock. Silastics and other special compounds are available on order.

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Circle 84 on Reader Service Card

ing"; Friday will be Machine Accessories, Drives and Control Day with the panel discussion on "Machine Drives and Controls".

The Friday sessions will be of special interest to the designers and users of hydraulic and pneumatic components and circuits. At one morning session H. L. Stewart, assistant sales manager, Logansport Machine Company will give a paper on "Power Chucking"; at the afternoon session J. C. Hanna, vice president and chief engineer, Hanna Engineering Works, will speak on "Principles for Selecting Pneumatic vs Hydraulic Drives". At the same session in the afternoon, E. H. Vedder, manager, Industrial Electronics Control Engineering, Westinghouse Electric Corporation, will speak on "Electronics in Motor Drives" and H. G. Keller assistant chief engineer, Link-Belt Company, will give a paper on "Mechanical Variable Speed Drives".

Plant Tours Are Planned

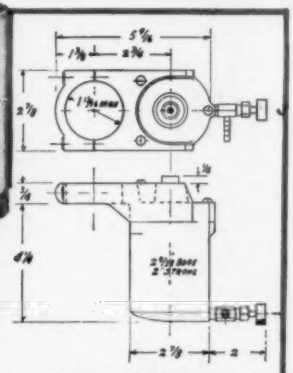
R. O. Knudson, special machine tool department, Greenlee Bros. & Company, will act as moderator for the panel "Machine Drives and Controls". The outstanding panel will consist of: K. H. Casson, chief engineer, Barnes Drill Company; D. B. Enyeart, design engineer, The Monarch Machine Tool Co.; O. J. Maha, vice president and chief engineer, Hannifin Corporation; R. W. Pashby, assistant to vice president, charge of Engineering & Research, Micro Switch Division; R. J. Owen, chief application engineer, The Louis Allis Company and a technical executive of Foote Bros. Gear & Machine Corporation.

Plant tours, always a feature of the ASTE annual meeting, will be conducted each morning. The range of laboratory and manufacturing plants scheduled for tours is wide so that visitors can make selections of visits most pertinent to their direct interest.

Complete copies of the program are available from ASTE national headquarters, 10700 Puritan Ave., Detroit 21, Mich.

Double your drill press output for $33.00

Mead Drill Press Feed mounted on spindle quill of drill press



DRILL PRESS FEED NO. 1
Specifications: *Power factor, 4 times line pressure; Stroke, 2½" (approx); Bore, 2½"; Capacity, ½" steel; Weight, 2 lbs. (approx).*

Use a new MEAD *pneumatic drill press feed for* DRILLING, TAPPING, REAMING

This simple, inexpensive device quickly converts standard drill presses into semi-automatic machines; doubles production on suitable jobs in many cases. Clamps to spindle quill in a few seconds. Automatically closes air fixture on work. Adjustable feed control and break-through cushion. Quick return. Easy to synchronize with automatic cycle equipment. Fits any size press up to 2⅜" spindle diameter. Use genuine Mead Pneumatic Drill Press Feeds for faster, cheaper, more profitable production. Get the facts—send coupon.

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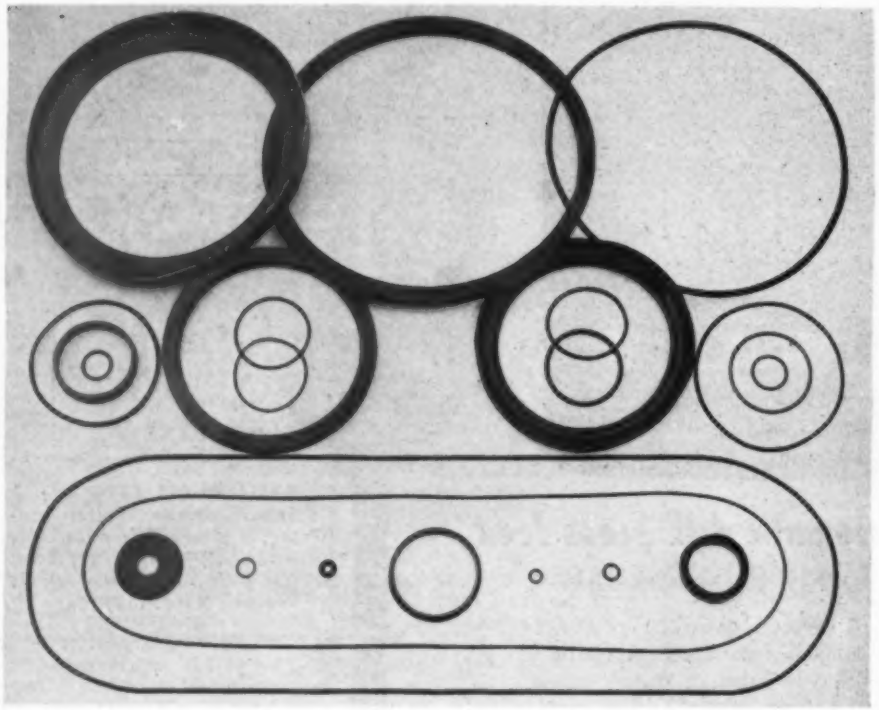
SYNTHETIC RUBBER

Custom Engineered

Synthetic rubber and Silicone "O" rings, lip-type seals and cups are constantly finding new applications formerly handled by leather, asbestos, flax and many other similar materials. They have been used in many applications to replace stuffing boxes, multiple packing sets, complicated adjusting devices and other expensive machined parts.



Acushnet produces great quantities of rings and seals to exacting specifications, and has developed many compounds and exclusive methods of fabrication for this type of part. Our long experience and quality controlled production assure the highest standard of precision. These items are made to order, none are stocked.

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Circle 1 on Reader Service Card

LETTERS to the Editor

We are interested in information which would assist us in procuring copies of hydraulic component symbols as published by J. I. C.

BRANDON O'REILLY
Plant Engineer,
Panelyte Div.
St. Regis Paper Company

The series of short articles on J. I. C. hydraulic component symbols which was published serially in APPLIED HYDRAULICS in 1951 are in the process of being published in booklet form. They should be ready for distribution by the time this issue is distributed.

Will you please advise where we will be able to obtain a copy of J. I. C. Hydraulic Standards for Industrial Equipment.

GEORGE F. SCHMIDT
Engineering Dept.
Buffalo Bolt Company.

As noted previously in this column, copies of the Hydraulic Standards may be obtained from J. C. Rauss, Production Engineering Section, General Motors Corp., 15-228 General Motors Bldg., Detroit 2, Mich. or from D. P. Morrell, Supervisor, Standards and Construction Applications, Ford Motor Company, Rouge Plant, Dearborn, Mich. Miller Motor Company, 2008 N. Hawthorn Ave., Melrose Park, Ill. also has published the Hydraulic Standards integral with a piece of sales literature.

We would appreciate your sending us tear sheets of the article "Nonflammable Hydraulic Fluids" by F. O. Hosterman, which appeared in the September 1951 issue of APPLIED HYDRAULICS.

R. K. RHODES
Dept. of Industrial Research
L. Sonneborn Sons, Inc.

A set of tear sheets has been sent to you.

Continued on page 48

is HYDRAULICS...

to help "power" your business

Blackhawk is a creative source of supply for hundreds of successful manufacturers

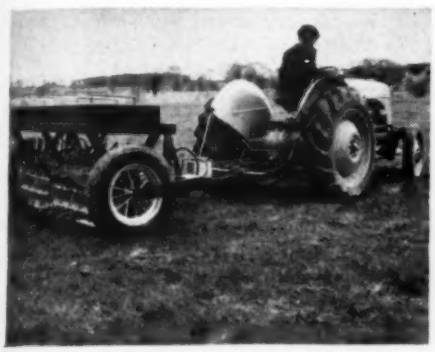
If you build agricultural, construction, or materials handling machinery — *or any other* product requiring positive, long-life, low-cost control — it will pay you to investigate the sales-building advantages of Blackhawk Hydraulics. For a single component, a complete hydraulic system or a self-contained hydraulic tool — here are three of many reasons why Blackhawk can help you build new performance, new economies into your product:

1. LOWER COST PER COMPONENT — Continuous, full-scale line production brings startling savings on a broad range of standard units.

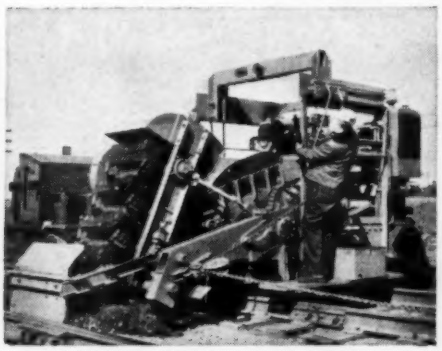
2. SAVINGS IN OTHER MATERIALS AND IN ASSEMBLY TIME — Dramatically compact design saves space and weight. Components for systems in all pressure ranges.

3. CUSTOMER SATISFACTION — Simplified construction has proved itself to be long-lived under the most grueling field conditions.

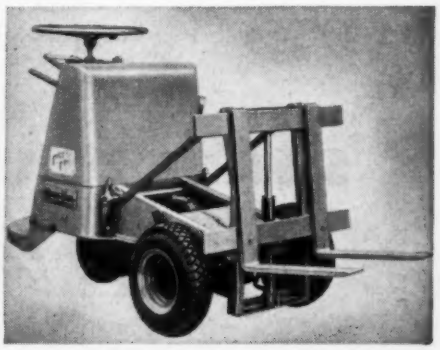
You are invited to take full advantage of Blackhawk's unmatched engineering and manufacturing facilities. Write for detailed engineering literature on the complete line of Blackhawk pumps, rams and valves for original equipment applications.



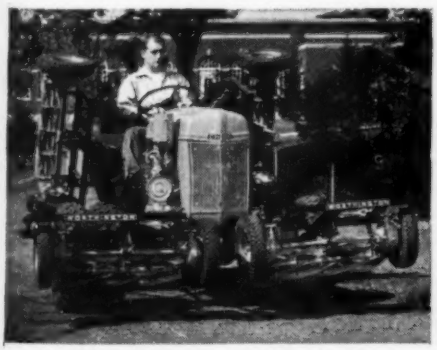
DIVOT DIGGER — Turf aerator loosens soil under grass cover without disturbing turf. Blackhawk hydraulic pump lifts and lowers the reel to clear obstacles.



BALLAST WASTER — Fouled railroad ballast is removed from roadbed and wasted over the bank. Blackhawk pump and valve control chain propulsion mechanism.



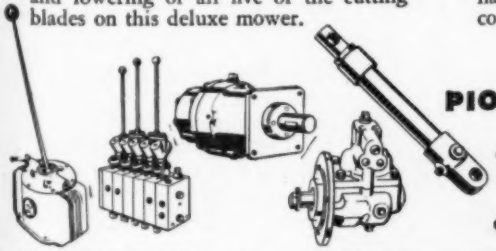
POWER WHEELBARROW can also be equipped with a variety of front-end attachments like this fork-lift which uses Blackhawk hydraulics to lift 500 lbs.



TRACTOR-MOWER — Blackhawk pump, rams and valve provide positive raising and lowering of all five of the cutting blades on this deluxe mower.

SEEDLING PLANTER — Plow and disc assembly are raised and lowered by a Blackhawk ram and "Power-Packer,"® a self-contained pump, valve and reservoir unit.

SERVICE TRUCK — Blackhawk hydraulic hand-operated pump permits easy lifting of loads up to 6000 lbs. Hydraulic safety valve prevents dangerous overloads.



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SEALOL

The Balanced Pressure Seal

Circle 95 on Reader Service Card

Letters to the Editor

Continued from page 38

The series of articles in the Basic Hydraulics Section of APPLIED HYDRAULICS has been of interest to our engineers, and the article in the October 1951 issue, "Rotary Hydraulic Motors", was especially good. We would like to have two complete sets of the articles.

HESTER L. DALE
Chemist-Librarian
Richfield Oil Corp.

We are sending tear sheets from as many of the 1951 issues as are in print which contain installments of the Basic Hydraulics. Some of the 1951 issues and practically all earlier issues are out of print. Haskel Engineering & Supply Co., 721 W. Broadway, Glendale 4, Calif., may be able to supply some of the other copies.

We are enclosing an order for one copy of the 1950 "Proceedings" of the National Conference on Industrial Hydraulics. Are other volumes available annually?

WENNERGREN-WILLIAMS
A. B.
Stockholm, Sweden

Your order has been forwarded to the secretary, National Conference on Industrial Hydraulics, Technology Center, Chicago 16, Ill. The "Proceedings" have been published for the past three years (1948, 1949 and 1950); the "Proceedings" of the 1951 Conference is expected to be ready shortly. Announcement will be made in this magazine.

I would appreciate it if you could supply me with a reprint of the article by T. McCuistion describing a new method of using "O" rings for reciprocating shafts. This appeared in a recent issue of APPLIED HYDRAULICS.

K. G. CARNEY, JR.,
Engineering Development Lab.
General Electric Company

A copy of Mr. McCuistion's paper "Floating Gland Design for Long "O" Ring Life" has been forwarded to you. (EDITOR'S NOTE: Reprints are still available from Mr. McCuistion's company, Precision Rubber Products Corporation, Dayton 7, O.)

Continued on page 50

Circle 67 on Reader Service Card

STANDARD LEATHER CUP SEAL ASSEMBLY SHOWN IS INTERCHANGEABLE WITH STANDARD PISTON RING PISTON ASSEMBLY

MILLER

High Pressure

HYDRAULIC CYLINDERS

Meet J. I. C. HYDRAULIC STANDARDS

(Write for FREE copy of these "Standards")

Years before the Joint Industry Conference (J. I. C.) Standards for specifying "quality" hydraulic equipment were adopted, the *standard* design and construction features of Miller High Pressure Hydraulic (2000-3500 psi) Cylinders already included ALL the specifications for cylinders, seals and pistons now called for by the "Standards". Hard chrome plated, scratch-resistant piston rods and dirt wipers have long been standard Miller cylinder features yet are required by the "Standards" only under severe conditions.

Solid steel heads, caps and mountings which eliminate costly, dangerous breakage even under the severest operating conditions represent an "extra-quality" standard Miller cylinder feature which actually exceeds the high quality set by the J. I. C. Standards.

The Miller "Patented" Hydraulic Piston Rod Seal which has no manual adjustment and is automatically self-adjusting and wear-compensating to give life-long leakproof service without ever requiring any manual adjustment whatsoever . . . far surpasses the requirement of J. I. C. Standard H6.2.5 which specifies "Stuffing boxes for automatic packing shall be so designed as to prevent adjustment beyond the functional limits of the packing"

"Write for Bull. H-104. Visit our Booth #1731, A.S.T.E. Show

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NO REPAIRS

NO MAINTENANCE

NO POWER WASTAGE

COMPLETE MILLER CYLINDER LINE INCLUDES: AIR CYLINDERS, 1½" to 20" BORES, 200 PSI OPERATION; LOW PRESSURE HYDRAULIC CYLINDERS, 1½" TO 6" BORES FOR 500 PSI OPERATION, 8" TO 14" BORES FOR 250 PSI; HIGH PRESSURE HYDRAULIC CYLINDERS, 1½" TO 12" BORES, 2000-3000 PSI OPERATION. ALL MOUNTING STYLES AVAILABLE.

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[illegible]les and Service from coast to coast

Engineers' Choice....
IN
HEIL
HYDRAULIC HOISTS
The Heil single-cylinder, twin-arm hydraulic hoist lifts this 4 yard all-steel Heil dump body fully loaded to full dumping angle in 12 seconds.
BURD
HYDRA-SEAL
PISTON RINGS
The Heil Company—along with other leading hydraulic hoist manufacturers—have found from careful testing and field experience that Burd Hydra-Seal Piston Rings are an excellent engineering choice. Hydra-Seal Rings seat rapidly, totally eliminate gap leakage, offer complete freedom from face leakage with no undesirable pattern of radial pressure. Proved in practice, they could be the answer to your own piston ring problems. May we submit the benefit of our experience in hydraulic piston rings as applied to your equipment? There's no obligation.
Write.
Let us send you this FREE bulletin on Piston Ring Seals in Hydraulic Cylinders. Write for Bulletin H-2 on your company letterhead.
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BURD
GRAF-FLOX
PISTON RINGS
Circle 17 on Reader Service Card

Letters to the Editor

Continued from page 48

I believe that the new APPLIED HYDRAULICS Directory is the best reference on hydraulic components to date.

ERICH M. HOFMANN
E. Hofmann Engineering Co.

Thank you Mr. Hofmann!

Having been made recipient of a subscription to your APPLIED HYDRAULICS recently, starting with the December issue, the article "A Beginner's Course in Basic Hydraulics, Part XI" interests me. What are the possibilities of obtaining the ten back chapters of these articles?

CAR H. SCHURGER
Chief Designer, Hor. Bor. Machines
Engineering Department
Giddings & Lewis Machine Tool Co.

The December installment ended the series "A Beginner's Course in Basic Hydraulics". We are sorry that the back issues containing installments are, for the most part, out of print.

Are the new Data Lists ready? We would like to have two copies for our design department.

J. P.

As announced in the January Directory issue, the 1952 APPLIED HYDRAULICS Data List is ready for distribution. We are sending two copies to you. EDITOR'S NOTE: Individual copies of the Data List will be sent to our readers on request without cost.

Would you give us the name and address of the manufacturer of the pressure switches mentioned on page 60 of the December issue.

HARRIS BROWN
Asst. Plant Buyer
E. I. Du Pont de Nemours & Co.

The manufacturer of the pressure switches is the Meletron Company. They are located at 950 Highland Ave., Los Angeles 38, Calif.

Hydraulics in High Tonnage Machinery

Forging

Briquetting

Extrusion

Stretch Press

Die Casting

Plastic Molding

Powder Metallurgy

TODAY, when aircraft frame builders are calling for extrusion and forging presses which are "as big as you can build them", the machine designer is giving careful thought to the development of hydraulic circuits which will meet the heavy power requirements.

The aircraft industry would like to have presses capable of developing 75,000 tons. Because of the tight schedules on military aircraft production, the top tonnage of presses now being built is 50,000 tons. It takes several years to build one of these presses, which means tying up a lot of shop facilities.

This 50,000 ton press will provide a considerable increase over the few American 18,000 and 16,500 ton presses now in operation. These multi-thousand ton presses are scarce for obvious reasons of cost, design and need. The projected program for forging presses calls for one press of 50,000 tons, perhaps two or three of 35,000 tons and three or four of 25,000 tons.

Present largest extrusion presses in this country are three 5,500 tonners. Presses capable of a 25,000 ton squeeze should be completed in 1953.

Hydraulic power which offers a great weight to horsepower savings as compared to other power sources is the means selected for creating these tremendous forces. The power is readily controllable. Automatic operation and adjustment of travel rates are obtained with suitable electrical control systems.

Development of high tonnage machinery has been a steady growth process, brought about by the need for larger structural members and the advancement of new production processes. There is a long history of hydraulic presses used for forming, forging, extruding, die casting and plastic molding. As parts get larger tonnages have gone up.

What are the hydraulic design problems? What components are used for heavy power requirements? On the next pages the design of a 1000 ton aluminum extrusion press is described.

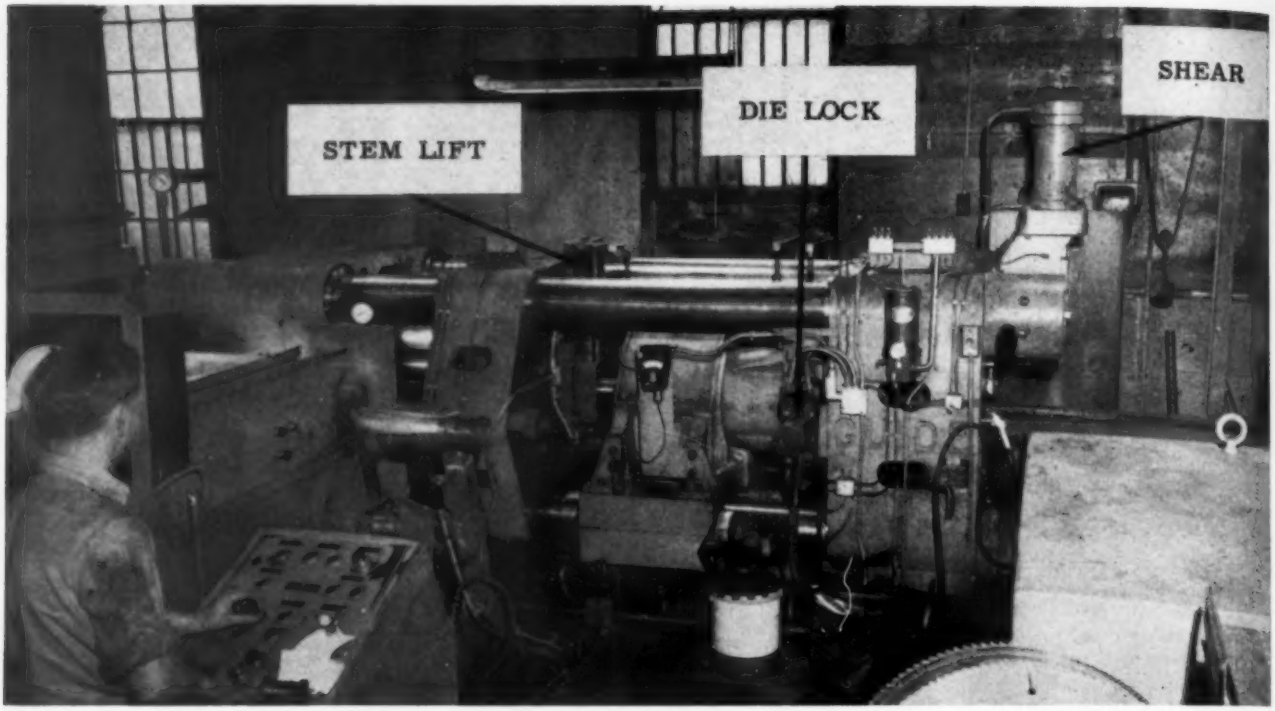


Fig. 1. A 1000 ton aluminum extrusion press in operation at the Youngstown Manufacturing Co. The heated billet is seen coming from the furnace into the pneumatically operated loader.

Circuit Designed for 1000 Ton Extruding Ram

IN an extrusion press at the Youngstown Manufacturing Company shop, hot aluminum billets are squeezed through dies to form ribbons of furniture and appliance trim. This 1000 ton press was designed and built by the Guide Company of Canfield, Ohio.

Circuit design of extrusion presses involves problems which are encountered in the design of die casting, plastic molding, forging and forming presses. Several of these considerations are:

1. *A prefill system for the large ram*
2. *Method of rapid travel*
3. *Decompression*
4. *Movement of die blocks*
5. *Loading the work*
6. *Locking of dies.*

The Guide press uses a 27 inch diameter single acting main ram and two 8 inch diameter double acting booster rams for the ram approach and return. The rams have a maximum stroke of 26 inches.

The radial piston, 3000 psi, 110 gpm, servo controlled pump is powered by a 150 hp electric motor. The circuit is designed to give a rapid ram approach of 260

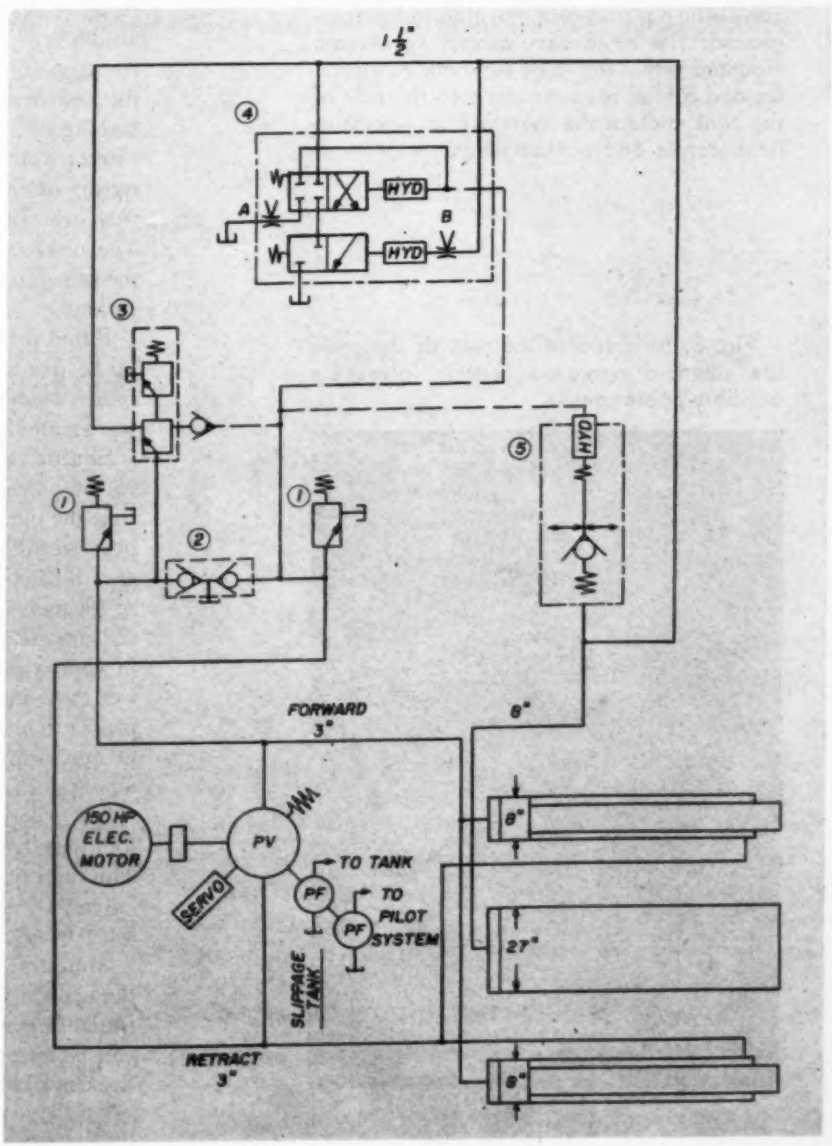
How much power can be built into a single hydraulic power source? Here's a 150 hp installation which gives 1000 tons on the extruding ram. A 25 hp circuit powers the auxiliary operations.

ipm, pressing speed 42 ipm and a rapid return of 520 ipm. The pump is a two-way delivery unit. To change pumping direction the electrically operated servo control shifts the pump element.

The automatic cycle is initiated from a push button pulpit station. Limit switches, tripped by successive cylinder movements maintain the cycle.

Following the 1000 ton circuit shown here, oil from the pump in the forward stroke is delivered to the head ends of the two booster cylinders. These are mechanically tied together with the main ram at the front platen. As the main ram is pulled forward, the suction created opens surge valve 5, and oil flows from the tank through an 8 inch line to fill the main ram.

As the ram contacts the work and pressure builds up, pressure oil from the pump opens pressure shift valve 3. The pre-fill valve closes and pump pressure is automatically exerted on all three rams. While the ram is rapily moving forward, valve 3 is held closed by oil trapped in the pilot line between valve 3 and the check valve 6. When the ram contacts the work, increased pump pressure shifts the spool of valve 3 forcing the trapped pilot oil out through the tank port and opening



The main ram power circuit.
1. Relief valves
2. Surge check valve
3. Pressure shift valve
4. Main cylinder release and by-pass valve
5. Surge check valve

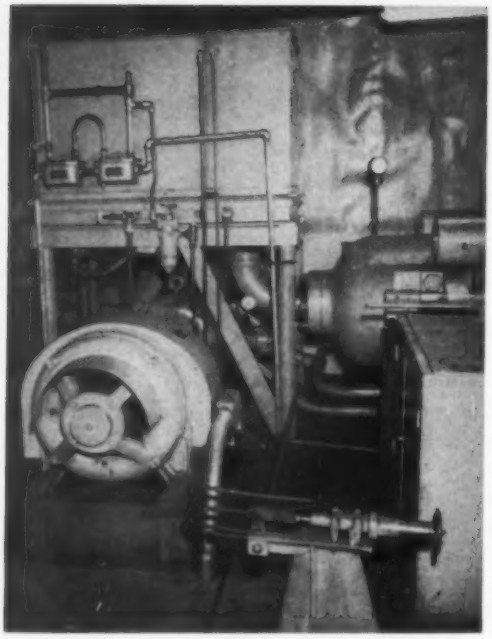
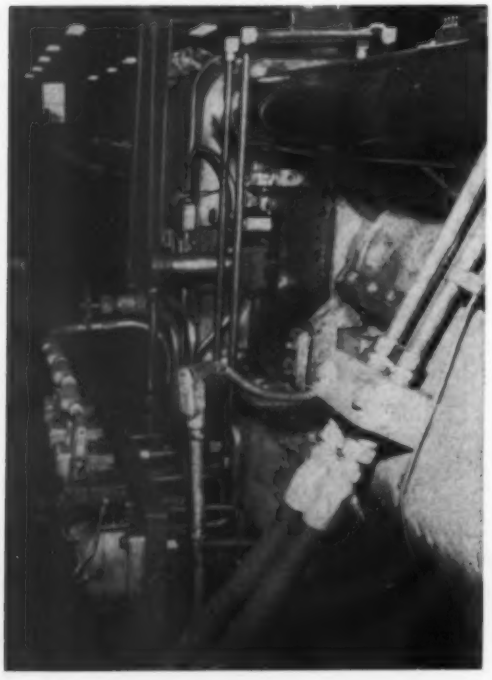


Fig. 2. A 150 hp electric motor drives a variable volume, radial piston two-way pump. The pump is controlled by the servo valve which is pedestal mounted in the foreground. The main ram control valves are mounted within the large reservoir. Oil coolers and a filter seen mounted on the side of the tank protect the system from excessive temperature and contaminants.

Fig. 3. Mounted at the rear of the press are solenoid operated control valves for auxiliary operations.



the pump pressure line to the main ram.

Under high pressure of approximately 2500 psi, the work is extruded. Just before reversal there is a considerable amount of energy stored in the oil. The release of the pressure must be controlled if shock and vibration of the press structure is to be avoided. This is the problem of decompression. It is solved by the use of valve 4; a main cylinder pressure release valve with pump bypass. This valve has two parallel spools acted upon by oil pressure opposed by springs. The J.I.C. symbol shows the flow pattern through this valve. During the pressure stroke of the ram, oil is trapped in the valve as shown. Immediately upon pump reversal, and pressure releases, pump oil shifts the upper spool of valve 4. This automatically by-passes to tank, through the lower spool, the oil discharged by the pump during the brief period required for pressure release.

Chokes Govern Decompression

This prevents a build-up of pressure on the pullback area of the booster rams during release of pressure on the main ram area. Pressure oil from the main ram area goes to tank through the upper spool past the adjustable choke A, seen in the drain line. Setting of this needle type choke adjusts the rate of pressure release. As pressure drops in the main cylinder, the spring at the end of the lower spool of valve 4 shifts the spool forcing oil, trapped in the pilot end, out to tank. The rate at which this oil is forced out is governed by the setting of choke B. When the lower spool is held all the way over by the spring, its exhaust port is closed off. The discharge of the pump is then used for retracting the ram. This decompression time is approximately one second.

Pump pressure holds the surge valve open to permit oil to drain from the main ram back to tank on the return stroke. Valves 1 are safety valves for the forward and return stroke.

Shuttle valve 2 is essentially two pilot operated check valves within one housing. This shuttle valve shifts every time the pump element is reversed to change the suction port on the pump, thereby switching direction of pressure oil between the forward and retract lines.

All the valves used in this circuit are mounted within the large tank seen in Figure 2. This tank has a capacity of approximately 450 gallons. While it is common practice to mount surge and control valves within a tank on press circuits, there are disadvantages which the designer must minimize. The most obvious problem is maintenance.

To make the valves reasonably accessible, the tank on this extrusion press is flange bolted around the base. This permits lifting away the tank shell to expose the valves. Of course oil must be drained and some piping must be removed.

Mounting high pressure valves in the tank minimizes the leakage problem. Leakage is approximately proportional to exposed fittings. Some leakage within the tank can be tolerated, and of course leakage within the tank does not result in lost oil.

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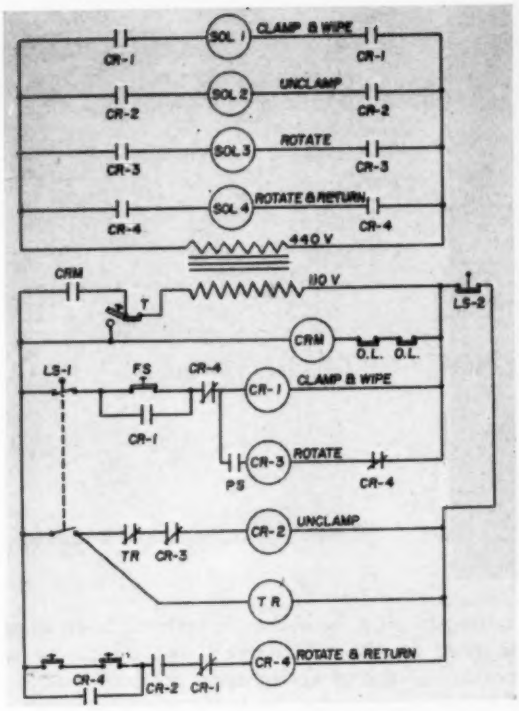
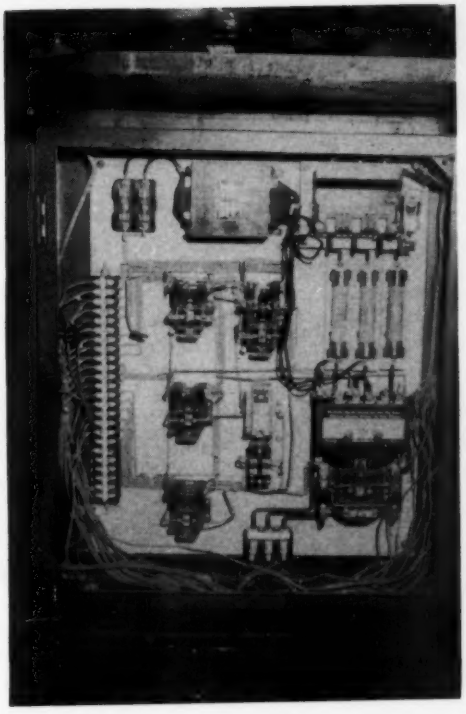




Layout of electrical components within the control panel provides for simple, efficient maintenance. Sufficient working space is given to permit quick tracing of lines.

Electrical Interlocks Simplify Hydraulic Control

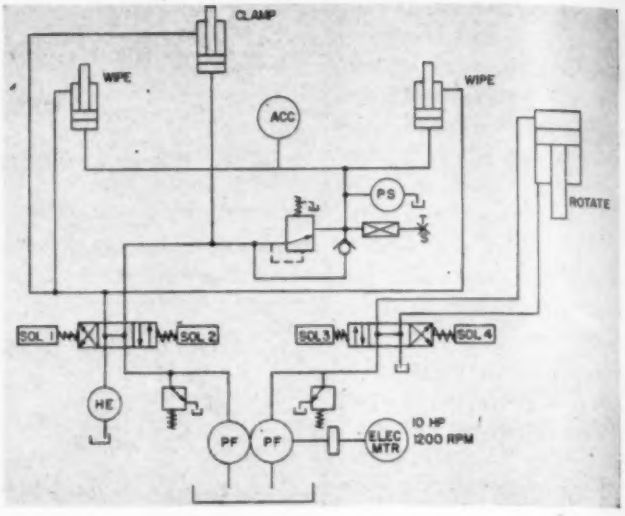
By M. W. Morrison

BECAUSE the automotive industry is continuously changing the shape and form of body parts, production machines for making these parts must be specially designed. Development of machines built at the Ternstedt Division, General Motors Corporation, Columbus Plant, is worked out with close cooperation between the men responsible for tooling, electrical layout and machine building.*

Production demands establish the need for equipment which will be automatic from load to unload. This means that motions must be fully controlled to have proper sequencing free from any possibility of "sneak" circuits. There must not be any unwanted motions. The circuit layout is to make it impossible for the operator to do any damage to either himself, the machine or the work by accidental tripping of push buttons.

When motions are powered by a hydraulic system

* See "Production Men Design GM's Benders" by Russell Simonson, APPLIED HYDRAULICS August 1951.



Hose is used to pipe the hydraulic system. Seen from the rear are the two-stage pump mounted on the oil reservoir, the oil cooler and all the control valves. The sequence valve and spring type pressure gauge are seen above the table top. The large gears under the table are turned by a cylinder powered rack to rotate the wiping tools.

the machine designer has every opportunity to build accurate safe controls into his machine by using electrical interlocks.

Shown here are photographs along with hydraulic and electrical circuit layouts for a Double Arm Bender which forms about 350 automobile roof drip mouldings per hour. This is a machine which we built from the ground up. The frame is an all welded steel plate construction having a 70 gallon oil reservoir built into the base. Mounted on top of the reservoir is a double rotor pump and its 10 hp electric drive motor. The oil cooler is mounted to the side of the tank.

Operating Schedule Requires Oil Coolers

Because our machines operate on a heavy schedule and any down-time would be costly, we have included an oil cooler and suitable thermostat controls on all machines. This is added insurance against high oil temperatures.

In-line relief valves are close coupled to each pump stage and the two solenoid operated valves are rigidly mounted on a panel at the back of the machine where hydraulic piping and electrical conduit can easily be assembled and serviced. High pressure hose provides simplicity to the piping network.

Three motions are performed hydraulically. First, the straight drip moulding is clamped at its center. Next, two wiping or ironing tools are pulled in to grip the stock against the form block. Third, a cylinder mounted under the table moves a rack meshed with two bull gears to rotate the wiper tools forming the part.

The operator has started the cycle on this Double Arm Bender by stepping on the foot switch. The wiping tool in the foreground is closed on the work by the cylinder seen on the table behind the form die. A small 10 cubic inch accumulator is seen extending above the hidden second wiping cylinder. This accumulator assures holding pressure.

While the control system is certainly not complicated, it includes all the elements of an industrial control system and illustrates their application. Proper selection of push-buttons, relays, limit switches, a pressure switch and a timer have resulted in a control circuit meeting our requirements.

Concluded on page 107

How to Prevent Overheating of Hydraulic Systems

Part 2 of a two part article on Hydraulic Maintenance

Based on his experience with plastic molding machines, last month Mr. Morse discussed equipment and methods for keeping hydraulic systems clean. In Part 2, he presents methods of maintaining oil at the proper operating temperature.

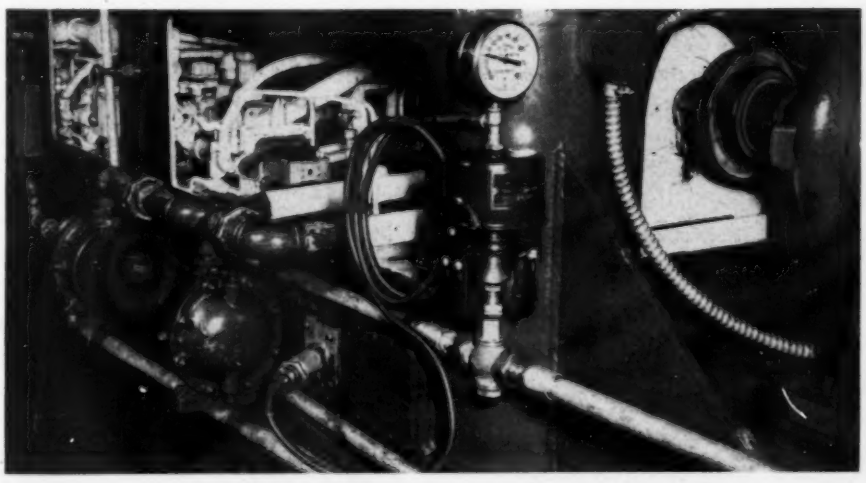
By A. R. Morse

A common cause of injection molding machine downtime is due to overheating of the oil. If the oil reaches a temperature over 120 F it can be said to be overheated. This results in excess leakage. It slows the actual cycle down as the oil thins out; and it causes trouble with packing glands through drying, shrinking and lack of lubrication necessary to the seal. Furthermore, overheating causes the oil to lose its lubricating qualities absolutely necessary for proper operation of all types of pumps and valves, resulting in scoring, galling and oxide film formation on precision parts. Excess heat causes sweating of the tank which adds dangerous moisture to the oil and causes it to break down with the formation of rust and oxides and acid derivatives which begin to circulate in the form of minute abrasive particles in the circuit. When an oil is brown instead of water clear it is an almost sure sign of overheating at some time or other, indicating acid breakdown of the oil.

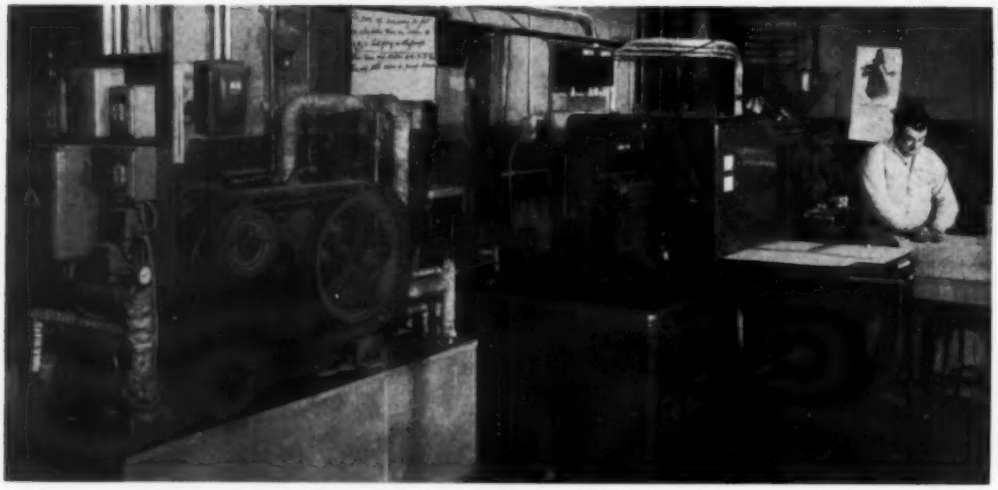
Again, we find the fault not entirely with the machine user. There exists a considerable difference in the appraisals of the various machinery houses as to the kind and extent of injection machine cooling required. Engineers typically underfigure the cooling, probably forgetting that in many places the water supply becomes low and warm most of the year, and again allowing theoretical consideration to take precedence over practical ones.

One make of machine has the cooling so piped that the faster the machine is cycled (and the more cooling

On this molding machine, oil temperature is maintained at 100 F by the use of a tube type oil cooler. Flow of cooling water is regulated by the thermostatically controlled valve. The thermometer is seen mounted above the valve.



A. R. Morse *is sales engineer with Injection Molders Supply Co., Cleveland, Ohio.*



To supply cooling water at a constant temperature of 45 F, regardless of the season, a mechanical refrigerating unit is used in this plastic molding shop.

is needed) the less becomes the amount of oil going through the cooler, as it is used in the circuit instead. By taking oil from the main relief valve for cooling, as in this instance, all the oil coming from the cylinders in actual operation is not available for cooling, but goes directly back to the tank. Where machines of this type run dangerously hot, repiping to cool all the used oil through an extra or auxiliary cooler often pays for the needed parts in reduced downtime and oil savings in a very brief period.

Certain full hydraulic machines also tend to run dangerously hot. Tacit recognition of this fact is given in the fact that medium or medium heavy oil is specified. However, in machines of this type, installation of an extra cooler is often a real economy, because pump repairs run into thousands of dollars. When incoming water is low in pressure and warm or when false efforts in economy are made to reduce the water supply to save on water costs, (or when someone forgets to turn the cooling water on) look out for trouble from hot oil! Oil temperature gauges are available so that the present guess work in this regard can be eliminated, especially on larger equipment. Use of thermostatic automatic temperature control valves greatly reduces possibility of overheating.*

Refrigerated Recirculating Systems

So serious is the problem of overheating in the injection machine field, and so costly is a fully adequate supply of cold water becoming in many places, that various expedients are tried. A well is one "out", provided local water does not carry objectionable salts which when present quickly ruin any cooler, and fill mold passages and pipes with insulating layers of carbonates, sulfates, etc. which cannot be removed. Softening of such water is very expensive, and has been discontinued in the plants where once used.

Is Refrigeration Practical?

Several hydraulic press applications are using mechanical refrigeration to assure efficient operation. It's a comparatively new method which will save a lot of production dollars on machines being operated at top capacity for long periods of time.

Two wells, one for supply and one for return are often tried. But the earth is a remarkable insulator and underground water does not flow fast enough to dissipate a great deal of heat, with the result that temperature build-up occurs, as in tanks or other closed circuits, and the water soon becomes useless for cooling purposes.

The matter of cooling towers has received some attention, but here the objection is that the cooling obtained from towers is always only a few degrees below ambient temperature. When the weather is warm the water also warms up until only the differential between wet and dry bulb remains—and this is not enough to condition water for efficient cooling of the injection circuit during the May-September period in particular.

Recently, several installations of the refrigerated recirculating type have been made in the injection field with very positive results. Not only has machine downtime been sharply reduced, (fewer leaks, fewer stuck valves, etc.), but oil life has been lengthened, and, in particular, production increased from 3 to 7 percent!

Concluded on page 95

*See "Temperature Regulation in Hydraulic Systems" by Don Morrell, APPLIED HYDRAULICS, December 1951.

Metal Bonding simplifies aluminum HYDRAULIC ASSEMBLY

AN application of the Al-Fin process—a method of molecularly bonding aluminum and steel—has been used at Fairchild Engine and Airplane Corporation, Farmingdale, N. Y., to connect hydraulic servo mechanisms with their actuating controls. A simple, compact and lightweight housing is produced which contains not only the connecting lines but the actuating pistons as well, so that the hydraulic cylinders become, to all intents and purposes, integral parts of the unit. Passageways through the housing are thin-walled steel tubes preformed to follow their required paths.

The tubes are bonded into the aluminum with the ends blind. Hydraulic fluid enters the chambers which form the hydraulic cylinders through slots milled into the tubing. Drilled holes of the proper cross section tap the lines for connection to the controls. Sealing at the control connection is made simple through the use of "O" rings.

Because of the bond between the walls of the tubing and the aluminum, there can be no leakage between the tapped holes, as would be the case if the tubes were cast into the housing.

The illustrations, Figures 1 and 2 show the bonding devised for a missile application.

The Al-Fin process was developed originally by Fairchild to improve the cooling of aircraft cylinder barrels by bonding aluminum fins to the steel of the barrels. In addition, the process has been used for the molecular bonding of bi-metallic pistons for heavy duty bus and truck engines, including diesel engines, bi-metallic brake drums and sleeve bearings and lightweight housings with bonded-in ferrous bearing retainers.

The missile assembly, like similar industrial applications, is extremely compact and greatly simplifies installations of high pressure hydraulic connections in a single, easily mounted housing.

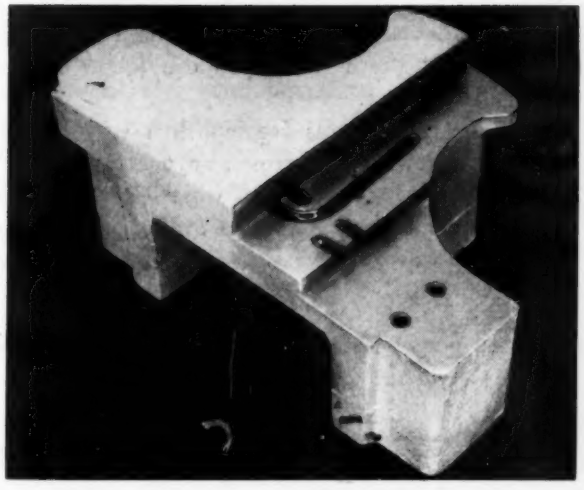
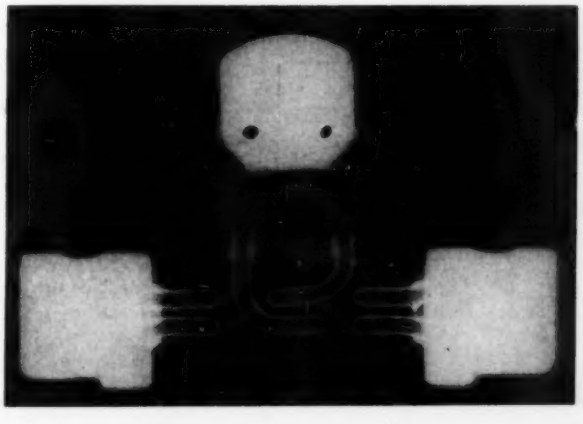


Fig. 1. Cross section of the base of hydraulic housing developed for a missile showing stainless steel tubing bonded in by the Al-Fin process. Cylinders are drilled in the three projecting sides of the casting.

Fig. 2. An x-ray photo of the casting which contains the connecting lines and the servo cylinders.

Photos courtesy Fairchild Engine and Airplane Corporation.



How Can J. I. C. Hy

What has been your experience in using J.I.C. symbols? Have you derived any new symbols? Is the present pattern as established by the Standards satisfactory?

One APPLIED HYDRAULICS reader makes the suggestions shown here. They're worth careful consideration.

HYDRAULIC symbols as established by the Standards have only been in use for about three years. In the Standards, the symbols are given for simple valves and offer a pattern which you can follow for more complicated valves.

The present symbols accomplish a very important job. By following the arrows, anyone can follow the oil path and get some idea of what is happening in a circuit without much knowledge of the actual construction of the valve. This assists the maintenance man to isolate problems. Then he must refer to the Bill of Material, find the manufacturer's catalog number and, if he does not know the part, must find out about construction in the catalog.

Present symbols are designed to give a drawing which is easy to make and simple to read. The Standards divorce the symbol from any one manufacturer's product.

W. T. McCormick, who has helped build and design hydraulic production installations for over 15 years, has taken issue with some of the basic symbols:

I should like to register a complaint as to the way designers and engineers are using J.I.C. symbols. It is my interpretation that these symbols are to be used and combined in a manner that depicts, in so far as is possible, a picture of the hydraulic, mechanical, and electrical actions and reactions within a hydraulic circuit. After studying many circuits as set forth in

Fig. 1

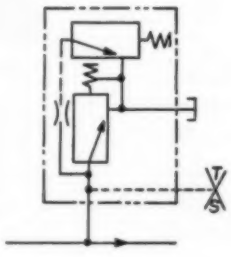


Fig. 2

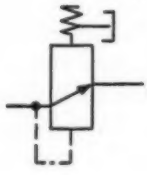


Fig. 3

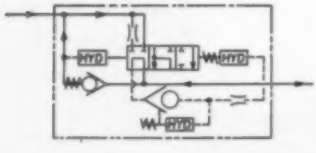


Fig. 8

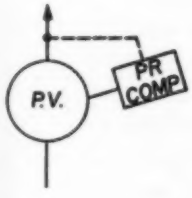


Fig. 9

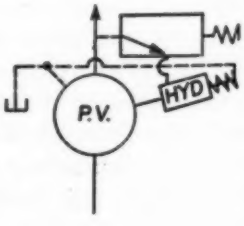


Fig. 10

Hydraulic Symbols Be Improved?

APPLIED HYDRAULICS and prints, I conclude the best use of these symbols is not being made. If we are not to revert to the confusion of the past, then insistence of complete development is essential. How do others feel?

From further study of the J.I.C. symbols, I believe them sufficient in scope that combining to give a true or nearly true picture is possible. These drawings are a few examples of how the symbols are now being used and how I think they should be extended.

Relief valves: The way in which the J.I.C. symbol for relief valves is used makes no distinction between a simplex and a compound type valve. Figure 1, as now used, should designate a simplex valve only. Figure 2 combines symbols to show a compound relief valve.

Sequence valves: Figure 3 is correct only when the fluid pressure acts on the total area of the spool. Figure 4 combines symbols to show a compound sequence valve. All internal drain lines should be shown and all testing ports which are in the housing should be shown.

Pressure reducing valves: Figure 6 is my derivation as compared to the present symbol, Figure 5.

Surge damper: My representation of a surge damper, Figure 8, tells a more nearly correct story than does the symbol in Figure 7.

Pressure compensated pumps: I suggest Figure 10 for a pressure compensated control of a variable delivery pump rather than Figure 9.

Check valves: Figures 11 and 12 represent a spring loaded check valve as differentiated from a gravity check. Since, springs are an essential part of hydraulic components, I believe they should always be shown.

Flow control valves: Figure 14 represents a pressure compensated flow control valve which shows more clearly the valve operation than does Figure 13.

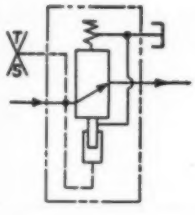


Fig. 4

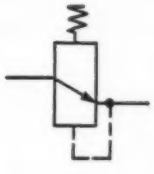


Fig. 5

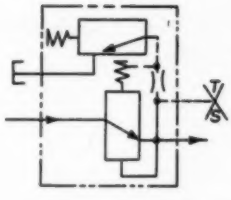


Fig. 6

Fig. 7

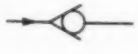


Fig. 11

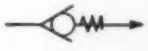


Fig. 12

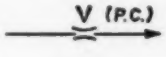


Fig. 13

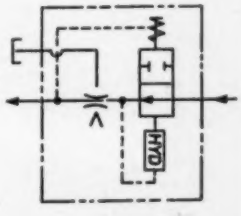


Fig. 14

Are High Speed and Control of Heavy Loads Your Design Problems?

By Richard E. Davis

THE carriage drive for sawmills is an ideal application for hydraulics because of the high speeds and forces needed and because of the necessity for very fine speed control. This application is quite different from the average industrial application.

Essential parts of a sawmill are the headrig or main saw, either circular or band, the carriage on which the log is held, and the drive which moves the carriage and log on tracks past the saw during sawing. To cut a board from the log the carriage is moved past the saw at the desired speed. At the end of the travel, the operator returns the carriage to its starting point and the log is set out in position to cut another board. Since in most mills sawing is done only in one direction it can be seen that the return time must be kept as short as possible in order to maintain production.

The length of log to be cut is variable from 6 to more than 40 feet. However, 16 feet is a good average log length. The average weight of a carriage for 16 foot logs is approximately 10,000 to 15,000 pounds. In extremely high speed mills the weight is often as much as 30,000 pounds. A round trip, 18 feet in each direction must be made in 4 to 6 seconds in high speed mills, therefore high power is necessary. The force required to do the actual work of sawing is very minor compared to that required to start and stop the carriage. Speeds of 600 to 1000 feet fpm are required on high speed mills, and forces of up to 10,000 or 15,000 pounds are often required to obtain these speeds.

Control is entirely manual. Because of the high speeds and heavy weight, control must be very precise and responsive. On a good drive the operator can control the reversal point to within fractions of an inch at speeds as high as 500 or 600 fpm. Control must be very smooth since the sawing speed must be varied by the operator to suit the size and condition of the log.

At first thought this would seem to be an ideal application for a hydraulic cylinder. However, there are

Richard E. Davis, is Pacific Northwest District Engineering Representative for The Oilgear Company.

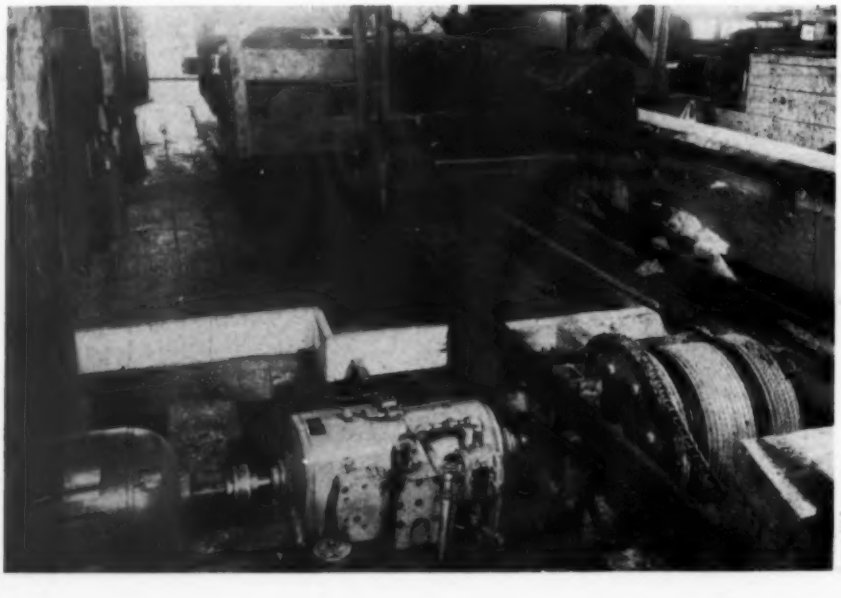


Fig. 1. The log is rapidly moved to the saw on a carriage. The 20 hp hydraulic transmission in the foreground drives the cable drum which moves the carriage.

Moving a log and carriage into a saw requires a power source which will move 30,000 pounds through an 18 foot stroke at speeds over 600 feet per minute.

How would you control the cutting feed and rapid reversal of this heavy load?

many difficulties. The cylinder stroke must be from 30 to 60 feet or more, and in order to obtain high speeds at reasonable oil volumes, the cylinder diameter must be small—3 inches or under is often needed. An ordinary double-acting cylinder would be rather impractical under these conditions and therefore short stroke cylinders are sometimes used with a cable multiplier to obtain long strokes.

For most smaller sawmills, it has been found that a rotary drive is most satisfactory for operating the carriage. A hydraulic carriage drive, Figure 1, consists of a pump supplying oil to an oil motor which drives a cable drum through the proper reduction. While a valve can be used to control the speed of the oil motor, this method of control is inefficient and produces a great deal of heat, especially in large drives. It has been found that the highest efficiency and best controllability is obtained by using a variable delivery pump to supply the oil motor and all control is then accomplished by varying the output of the pump. This arrangement gives constant torque on the cable drum. On the drive shown in Figure 1, a 20 hp variable speed transmission is used. This unit consists of a variable delivery pump and a constant displacement motor in one housing. A hydraulic servo on the side of the pump is connected by a lever to the sawyer's control lever.

On later drives, a separate pump and motor are used connected by pipes. This is necessary as larger drives are needed and because a new and better hydraulic motor has been developed. Because of the rapid reversals required, the inertia of the motor must be kept as low as possible.

There are a number of interesting engineering problems connected with the carriage drive. When the carriage is to be reversed, the operator normally throws the control lever to the full speed reverse position as fast as possible. However, because of the inertia of the

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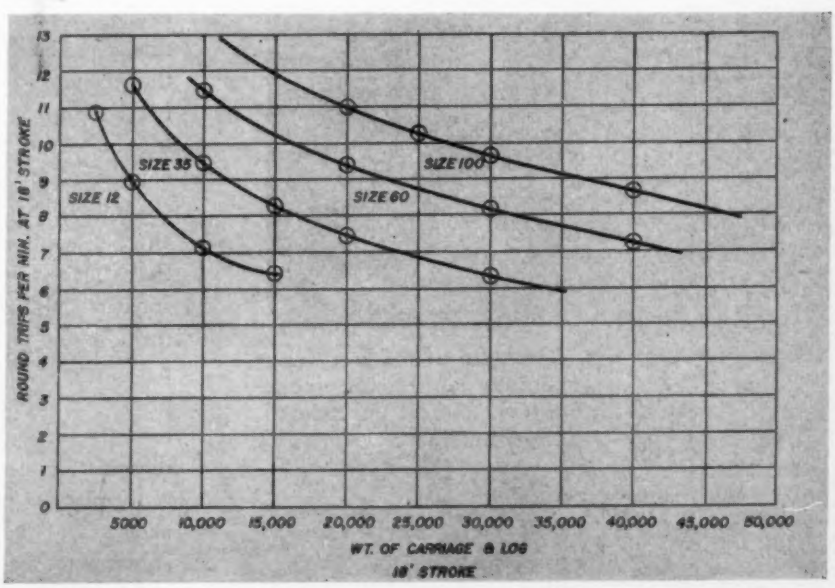
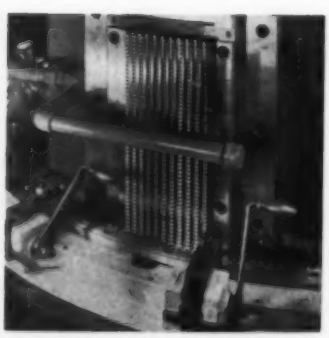


Fig. 2. Selecting the proper drive is simplified by the use of these curves which illustrate the ability of each drive to move the heavy loads at high speed with fast reversal for the 18 foot stroke.

REVAMPED BROACH CIRCUIT
solves turret gear supply problem

Internal ring gear for tank turret is over six feet in diameter.



Closeup of the broaching operation at the last index position. Two of the manual clamps are seen.

PRODUCTION engineers of the Detroit Tank Arsenal and Colonial Broach Company found a way to get around the current long delivery time on new machine tools, when they set out to develop a machine that would cut the 294 internal 4-pitch teeth in the 6 foot diameter ring gear for tanks.

They simply looked around the Arsenal, found a World War II surplus Colonial surface broaching machine that could be spared, and re-tooled the machine at the Colonial plant to do the new job. The new machine does in 30 minutes what former methods took 4½ hours to do, and is already saving $400 per day in the production of turret ring gears. In addition, the machine eliminates ¾ of the capital outlay and ⅞ of the number of machine tools required in the method previously used.

The idea of using broaching instead of conventional gear cutting methods to produce internal teeth is not new but the idea of using a surface broaching machine to cut 294 of these big teeth in a 6 foot diameter gear in only 27 cutting strokes of the machine certainly was.

Normally an entirely new machine design would be evolved for such a development. Colonial got around this by removing the hydraulic power equipment from the inside of the column and placing it on an outside base, repiping the system, and installing a 4 ton indexing and shuttling fixture which completely encircles the column of the machine.

The teeth formed by the broaching operation are checked while the part is still in the machine. The gage that checks the part both for tooth spacing and size is integral with the index fixture and actually passes through the column of the machine. To produce the part to a tolerance of .001 inch spacing required high precision in machining the fixture. Eccentricity on the assembled fixture is less than .0005 inches per foot of diameter.

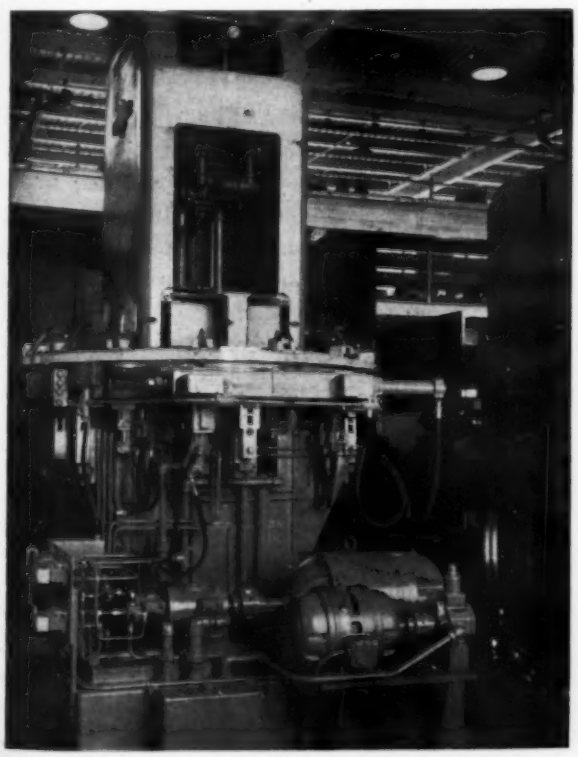
Despite the use of World War II surplus equipment, accuracy of the broached gear teeth is so high that no subsequent gear finishing is necessary. Because of the

Indexing the turret ring is accomplished by hydraulic cylinders. These rotate the part in the fixture to the next position where a hydraulically controlled index pin locks the fixture in accurate indexing location. The turret ring is clamped in the fixture by hand clamps and is ejected hydraulically for unloading. The selection of an 11 tooth broach was dictated by the capacity of the machine available at the time. One of the fixture index hydraulic cylinders is at the right of the operator.

striking reduction in machining time achieved, one broaching machine will add just as much production capacity as would approximately eight of the type of machines used to produce the gears during World War II.

A rear view of the machine showing one of the fixture index cylinders at the rear of the fixture. All hydraulic power components are on a base at the rear of the machine. Note the rollers on which the fixture slides back and forth into and out of broaching position. The large double pump powers the broach ram. The vane type pump at the right mounted on the bracket in front of the tank supplies oil for the fixture indexing, locking and unloading cylinders. Solenoid control valves are mounted on the panel at the left end of the tank. Separating the hydraulic power system from the machine frame greatly simplifies construction and maintenance.

Broaching the 294 teeth on the ring gear is accomplished by a combination of indexing and shuttle movement of the fixture. In operation the fixture first moves into cutting position under the 11 tooth, 12 segment surface broach 9 inches wide by 60 inches long. After the broach has been passed through the work, the fixture moves out of cutting position and the broach is returned to the top of its stroke. Shuttle movement is accomplished through a hydraulically controlled locking cam action.



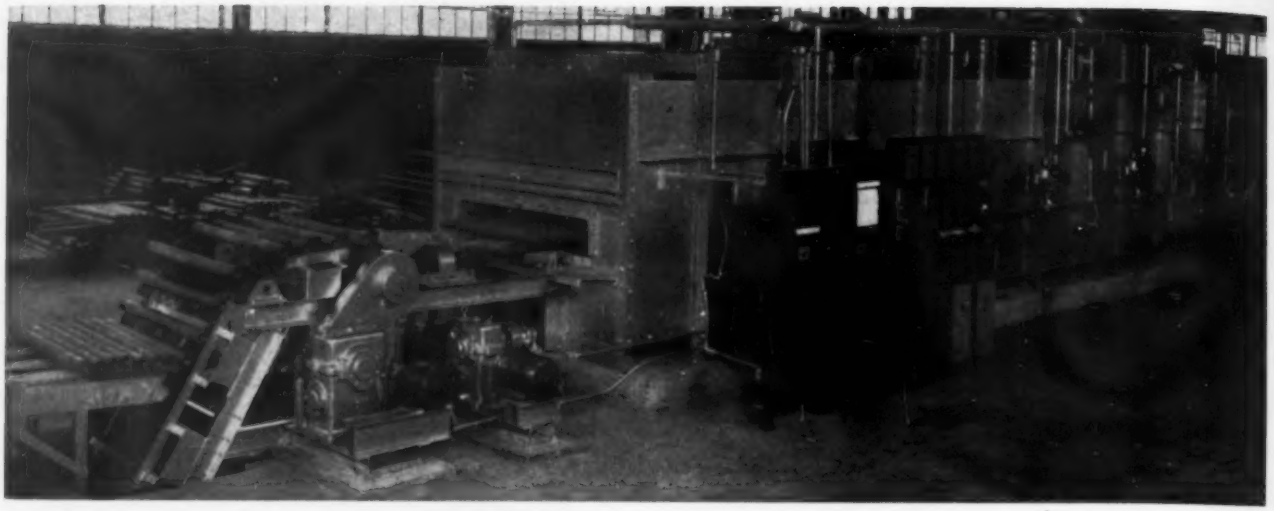


Fig. 1. The charging end of the automatic billet heating furnace, showing the charging conveyor (left), screw feed drive and control panels. The bracket (right, end of furnace) is the mounting for one of the two horizontal cylinders which centrally locate discharging billets.

OPENS THE DOOR

to furnace economies with hydraulic power

A BILLET heating furnace in the plant of Reading Tube Corporation, Reading, Pa., manufacturers of copper and brass pipe and tubing, employs automatically controlled hydraulic circuits for opening and closing a discharge door, for centering billets before ejection and for operating an elevator to position the billets for the next operation. After a careful survey and with the factors of simplicity and ruggedness, initial economy of installation and low maintenance analyzed, hydraulic operating equipment was selected. The motor driven oil hydraulic pressure system actually cost less than a number of separate motor driven mechanisms to accomplish the same purpose.

A billet furnace, manufactured by The Electric Furnace Co., Salem, O., was equipped with a screw feed conveyor. A charging conveyor picks up billets singly from an infeed line. The billets drop off the conveyor, roll by gravity toward the furnace entrance, where they rest against the end of the feed screw. Both charging conveyor and furnace feed screw are driven by geared motors (Figure 1). The third motor is an integral part of the hydraulic power package unit.

A billet heating furnace equipped with a hydraulic package power unit and cylinders to operate centering of billets, the opening and closing of the discharge door and the operation of an elevator. Economy and low maintenance were the major factors in selecting the hydraulic equipment.

At the discharge end, a hydraulic cylinder raises and lowers the discharge door and two hydraulic cylinders, horizontally mounted, act as a centering device for the discharging billets.

Cycle of Operation

When the furnace is ready for operation, the operator actuates a push button, starting all three motors through thermal relays. The operating cycle is then initiated by either of two start push buttons, one used for single cycle, the other for continuous automatic cycle operation. This starts the motor-drive operated mechanisms for rotating the feed screw conveyors. The feed screw rotates one revolution. The discharge door opens automatically. The last billet, freed by the rotation of the screw, rolls free at the discharge end.

When the billet has passed over a limit switch, a four-way valve automatically reverses, and the discharged door lowers and closes. Then, in a sequence controlled through a master sequence timer, the centering cylinders, one on each side of the furnace, move the next billet to the center position.

One centering cylinder is located just ahead of the discharge position; the other, on the opposite side, is back toward the charging end, approximately the linear distance the screw moves the billets in one revolution. The center line of the outer cylinder is the center line of the billet that is discharged next. The center line of the inner cylinder is approximately 10 inches back or toward the charging end. If the billet, as it nears the discharge end, is off center the inner cylinder moves the billet toward the center of the chamber. As the screw moves the billet to the last position before ejection, the outer cylinder moves the billet to the center of the chamber.

The centered billets, when cleared by the last revolution of the screw drive, roll down a short inclined tray onto the elevator. The elevator raises each billet and discharges it into the trough of the piercing mill.

Hydraulic Circuit

A standard hydraulic power package unit with a 5 hp motor driving a multi-vane pump through a flexible coupling, delivers 14 gpm at the relief valve setting of 400 psi. A right angle check valve, air bleeder and pressure gauge are installed between the relief valve and the four-way valve. Separate motor drives are provided for the furnace drive and the charging conveyor.

Three double solenoid operated four-way valves control the oil flow to and from the cylinders, one valve serving both centering cylinders, one each for the discharge door and elevator cylinders. Counterbalance valves are installed in the valve-cylinder supply lines of the discharge door and elevator cylinders. Cylinder supply and return lines are equipped with air bleeders and shutoff valves.

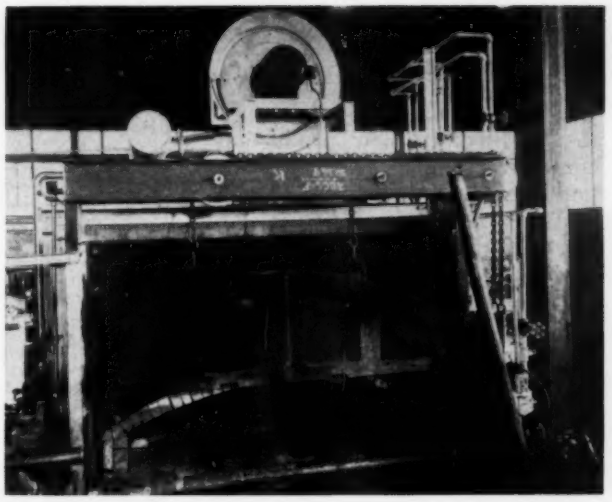


Fig. 2. The discharge end of the furnace, showing the furnace screws and an ejected billet. The hydraulic cylinder that operates the door is at the right, shielded by the furnace wall from the heat.

Fig. 3. A maintenance man checks the furnace operation. The discharge door has just closed, an ejected billet is on the discharge tray. Note that operating components are out of the path of the furnace heat.

Electrical Circuit

Three motors, 5 hp for the package power unit, 2 hp for the furnace drive and 1 hp for the charging conveyor, are the prime movers. Each starter is equipped with thermal relays. A time delay relay in the charging conveyor circuit times out only after the billet on the elevator has been removed, permitting a new cycle to start. An automatic repeating timer in the starter push button station times out to open the discharge door. An overall or master sequence timer, a geared motor driven, cam operated, time cycle controller, wired to limit switches, relays, including solenoid contactors of the three four-way valves, takes over at the start of a cycle.

Concluded on page 116

1 Setting up new production equipment requires close cooperation between all departments. These four men help to make it possible for the Tappan Stove Company to have their own manifold production equipment. At the drawing board, tool designer LeRoy Stahl is indicating some of the design features to (left to right) J. G. Hoff, Sr., preliminary study; Jake Streitmater, foreman of the department; and G. L. Dobson, chief production engineer.

DECIDING to keep work in the shop or farm it out is a constant concern of production planners. If you are in the business of manufacturing durable goods like automobiles, stoves and washing machines, it's most likely that flowing into your final assembly line are many parts which have been made by subcontractors. You may have felt that making the part required special tooling and know-how which could most economically be supplied by some outside shop specializing in that sort of work, or maybe you just haven't had the space or the personnel.

But, along comes a part, being made "on the outside" which gives you trouble — possibly it is delivery or control of manufacturing tolerances or maybe it's just that plain but not simple cost factor.

You begin to consider making the part in your own shop.

That's the sort of decision which confronted the men at the Tappan Stove Company in Mansfield, Ohio. The part which they decided to tool up for in their own shop is the manifold pipe used in their line of gas stoves.

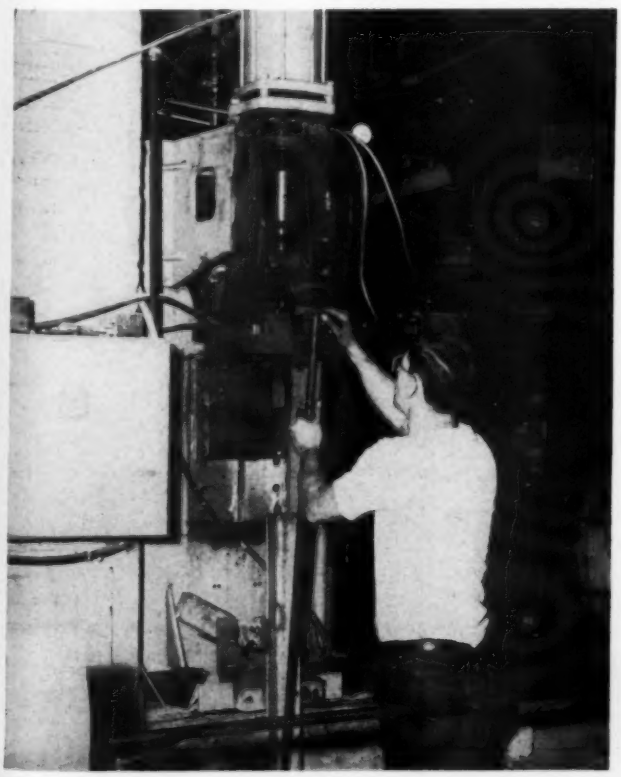
To produce this part meant setting up a complete line, adapting some standard tools and completely building some special machines. In a picture study APPLIED HYDRAULICS takes you through each operation of this new line showing the careful application of air and oil power to each production step.

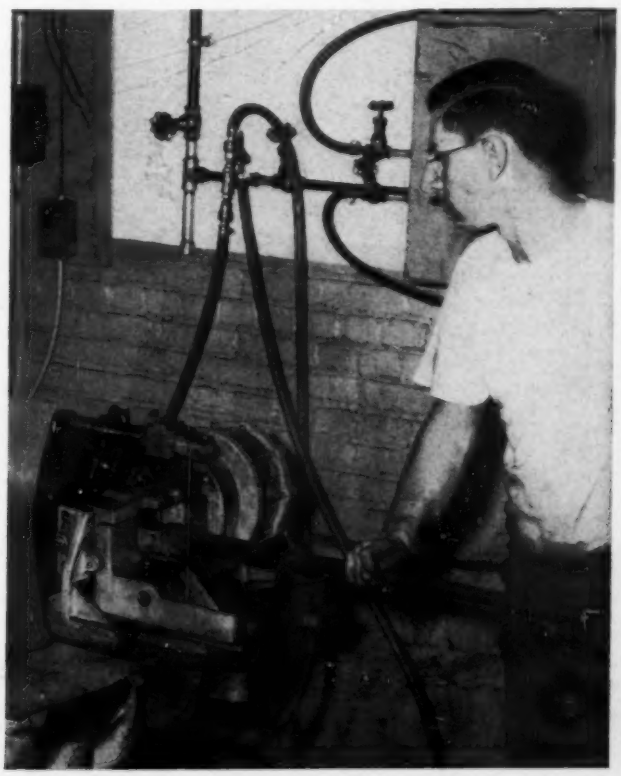
2 Layout of the line was made to provide simplicity to the handling of material. Directly from a rack on the incoming materials dock, the operator feeds the raw stock into a cut-off machine. The pipe is cut to length and at the same time the end is brushed in preparation for welding. Operation of this machine has been improved by installing a clevis mounted air cylinder, seen at the base of the machine, to feed the cutter head. Out of view to the right is a positive stop. Once the pipe is in

In-Shop Production Planning Uses Air and Oil Know-How

place a small air cylinder actuated by a limit switch controlled air valve pulls the stop away from the pipe to free the pipe during the cut-off. Cut-off pipe rolls into the cradle rack.

3 and 4 The air powered welder in which a cap is welded to the end of the manifold pipe is located just behind the rack holding the cut-to-length pipe. Having welded the cap in place, the operator loads the pipe into an automatic threading machine which was specially converted for this line. Air cylinders were added to make the operation automatic. The clamping cylinder is mounted at the right. The feed cylinder, which is mounted at the rear of the machine, is controlled by limit switches on the pneumatic clamp and the threading head.

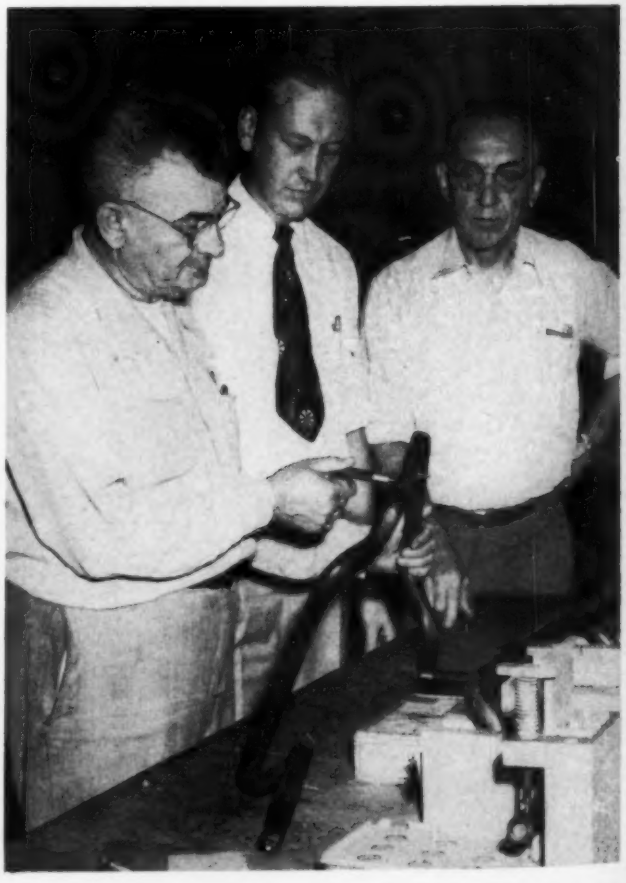




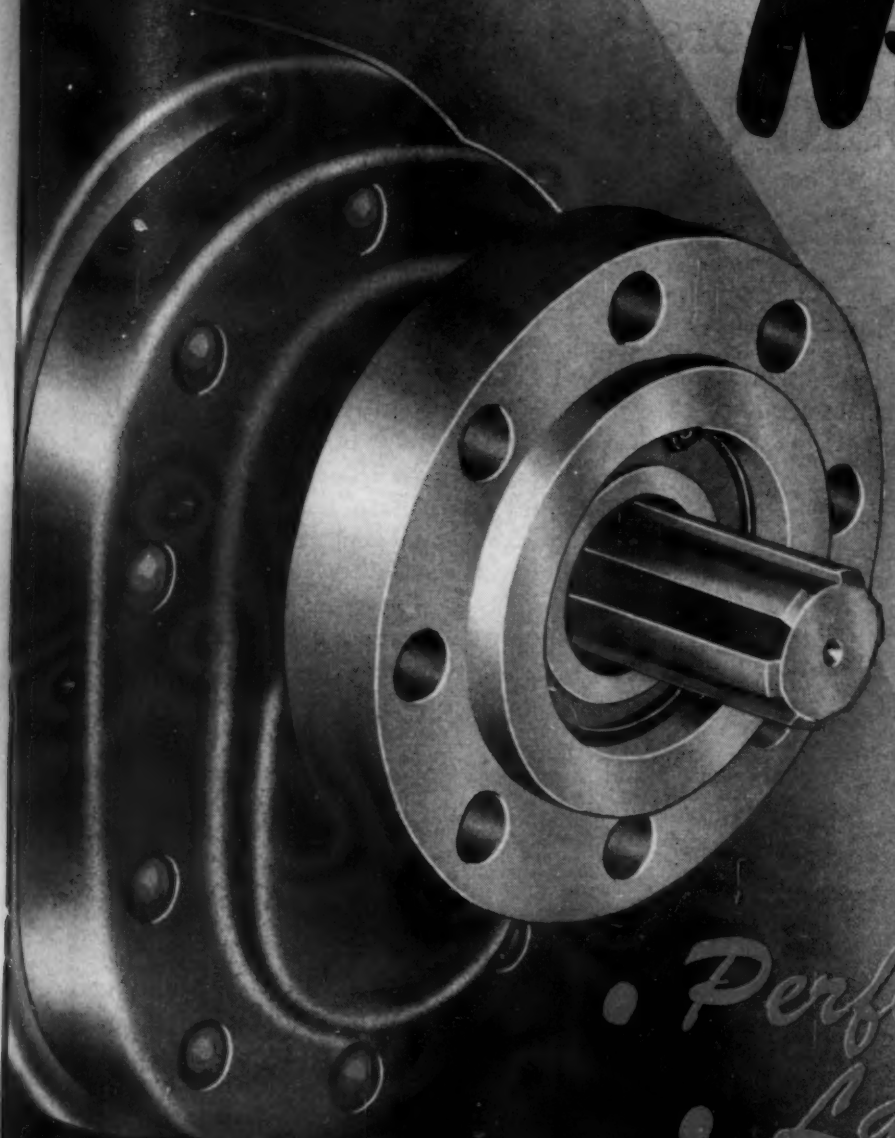
5 Two special hydraulic benders were designed to form the manifold. The first bender, at the right, is operating while the operator loads the second bender. There are nine bends in the pipe, twisting the parts in several different planes. All motions are sequenced hydraulically and several of the actuating cylinders are clevis mounted to swing with the forming tools providing smooth flow of material at the bends. After bending, the pipe is tested under water with air pressure to be sure the manifold is free of any leaks.

6 From the water tank test, the manifolds go to a press to have holes pierced for fitting. The holes are then tapped in an automatic tapping machine which uses an air powered table to transfer the manifold to the various positions required for tapping. A hydraulic control cylinder is used to decelerate the table speed at each stopping point, and also control the table's maximum speed. Air clamps hold the part. Solenoid operated air control valves are seen in the foreground.

7 Between the tapping machine and this final inspection station, the manifold has been to a welding machine located in the line to weld the three studs in place. The fixture shown here checks the bend controur and hole positions.



The NEW -PD- SERIES



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QUALITY IN EVERY TURN

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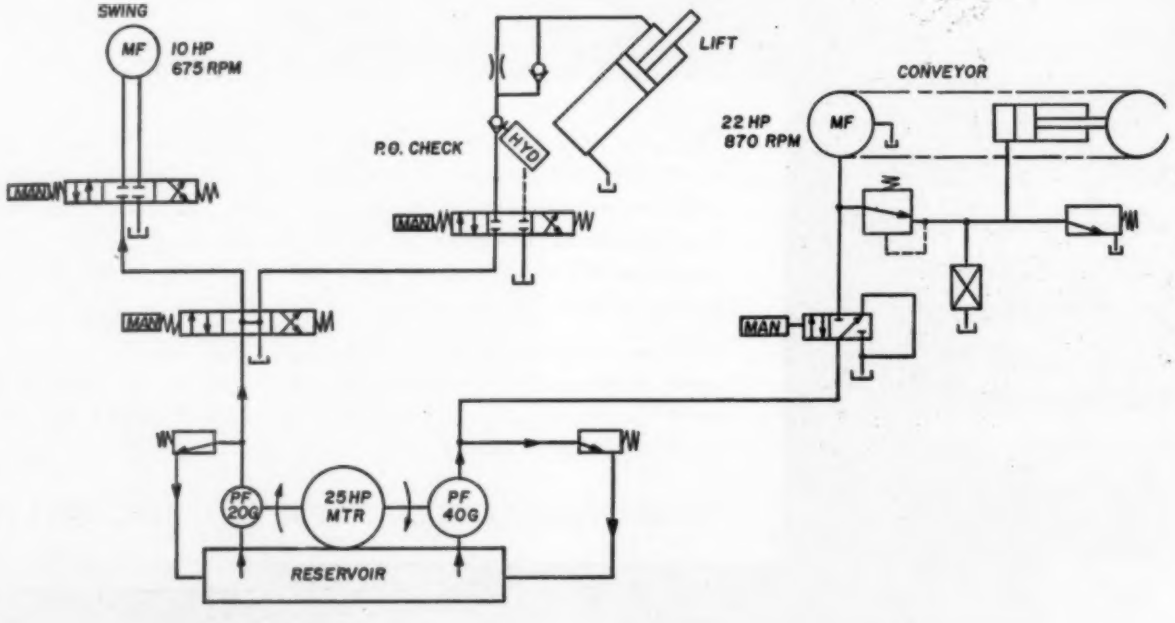
Fluid Motors Selected for EXPLOSION-PROOF DRIVES

ONE of the problems of handling certain bulk chemical materials is the elimination of fire hazard. To minimize this hazard designers of the boom stacker, in use at the American Cyanamid Company, chose hydraulic drives. Fluid power is easily controlled by a compact 25 hp unit.

A 10 inch diameter, 69½ inch stroke, single acting cylinder is used to raise and lower the 70 foot conveyor boom plus or minus fifteen degrees from the horizontal position. The lift cylinder is located at the pivot, near the counterbalance load, so that oil pressure on the rod end drives the ram down to pull the boom up. The boom is held in position by placing the manually operated four-way valve in closed center neutral position to trap oil in the cylinder. Gravity lowers the boom when the manual valve is shifted. Oil from the rod end flows to tank through the needle valve which regulates rate of downward travel.

A 10 hp gear type rotary fluid motor is used to swing the boom 180 degrees. A second 22 hp gear motor drives the conveyor. Bulk material can be stacked at a 60 foot radius to the peak of the pile.

Hydraulic Circuit for Boom Stacker



The world's first self-contained hydraulically operated, belt conveyor, boom stacker built for the American Cyanamid Company. The stacker features a hydraulic ram for raising and lowering the 70 foot boom, hydraulic motors for driving the belt and slewing the boom, and a hydraulic tension take-up for the belt. The machine is capable of stacking bulk material at a 60 foot radius to peak of pile.

Tension on the conveyor is maintained by two 2 inch diameter, single acting, push type cylinders. Since belt tension is a static load, a reducing valve is used to maintain constant pressure of 250 psi on the cylinder. Because overtightening could be caused by inadvertently setting the valve too high, a relief valve set at approximately 300 psi is installed to limit the tension and protect the belt and machine members.

The one direction conveyor does not have a brake. It is designed to coast to a stop.

The hydraulically powered stacker, built by Derrick & Hoist Co., Inc., has proved to be an efficient unit. An unloading job which formerly required eight days can now be done in three.

THAT'S WHY THEY USE THESE

NAMCO SOLENOIDS

They're the modern, up-to-date way of doing jobs automatically—by remote control, and in cramped quarters if necessary.

With the positive, accurate action of Solenoids you can simplify design, manufacture and operation. They're taking the place of expensive, bulky gear trains, levers, linkages and other mechanisms. Many a manufacturer has come to us with a cost or space problem—and has found the solution in Namco Solenoids.

Namco Solenoids—with "Stellite"—welded contacts, are compact, rugged and reliable. They're *engineered* to the requirements of the job with the aid of an *expert*. That's where we can help you. We'll be glad to recommend the size and style best suited to your job—with standard or special terminal blocks and mountings. Like more details? Ask for bulletin EM-46A.

Precision performance and dependable, high-speed, heavy-duty operation—those are service characteristics every Namco "Stellite"-welded Solenoid takes in its stride. It's the top choice of machinery-builders for other reasons, too—compactness, simplicity, low current consumption are just a few. Available in either push or pull type (up to 25 lbs.) in a variety of standard mountings to meet every commercial need. Our engineers will be glad to help you select the size and type, either standard or modified mounting, to fit your exact requirements.

Complete standard range of Namco "Stellite"-welded Solenoids is illustrated and tabulated in Engineering Bulletin EM-46A. Ask for your copy.

ELECTRICAL MANUFACTURING DIVISION

THE NATIONAL ACME CO.
ELECTRICAL MANUFACTURING DIVISION

Circle 71 on Reader Service Card

Concluded from page 69

Tumbler switches for stopping furnace drive or elevator drive are provided.

Actuation throughout is by limit switch. The furnace has a total of 12 standard, heavy duty, operating arm and roller type limit switches; three on the furnace drive; two each on the centering cylinders; two on the discharge door; and three on the elevator.

The elevator must be down for the circuit to start. A normally open LS closes when the elevator is down. When the elevator is raised, a second normally open LS is closed, starting the time delay relay. A third normally open LS is closed when the billet is on the elevator, actuating a magnetic relay.

Twelve Limit Switches Control Automatic Sequence of Operation

On the charging conveyor a normally open LS held closed by a counterweight, is opened when a billet strikes a knocker, stopping the charger conveyor drive. The furnace drive or feed screw, actuated through a relay, turns one complete revolution. A single pole double throw LS, operated by the knocker on the shaft drive, moves a sequence timer one position. After the screw feed completes one revolution, a normally closed LS is opened by the knocker, stopping the screw feed motor.

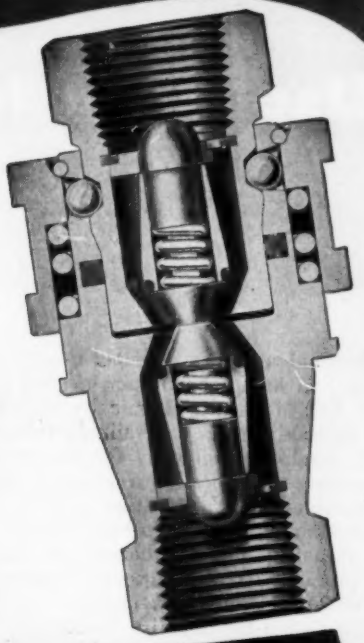
As the automatic repeating timer opens the discharge door, a normally open LS is closed, starting the screw feed drive motor. When the billet passes over a single pole double throw LS, a four-way valve automatically reverses and the discharge door is lowered. This de-energizes a magnetic relay, moving the centering cylinders in.

The LS of the centering cylinders are wired parallel; normally open LS close when the centering cylinders are in, reversing the cylinders. When the cylinders are out, normally open LS close, clearing for the next cycle.

"NEW" FOOLPROOF

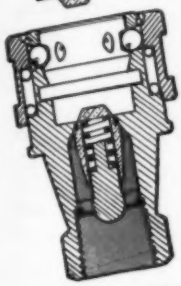
HANSEN

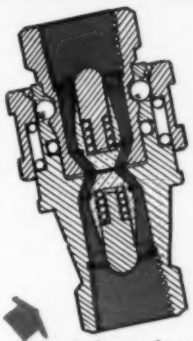
HIGH PRESSURE 2 WAY SHUT-OFF COUPLINGS



SEALS BOTH ENDS OF LINE AUTOMATICALLY INSTANTANEOUSLY

Red section shows how torpedo type valves contact valve seats in both socket and plug to provide instant seal of fluid in both ends of line.





Identical torpedo type valves in socket and plug are mounted to permit free flow of gas or liquid through connected coupling.

Hydraulic and pneumatic lines can be quickly, easily, and safely connected or disconnected with the Hansen High Pressure Two-Way Shut-Off Coupling—with both ends of line positively sealed when coupling is disconnected.

To connect, you merely pull back sleeve and push plug into socket. Identical torpedo type valves in plug and socket are mounted to permit free flow of gas or liquid when coupling is connected.

To disconnect, just pull back sleeve—coupling immediately disconnects, valves automatically and instantly seal both ends of line.

Plugs and sockets furnished with ½", ¾" and 1" Female Pipe Thread connections.

CAN BE AUTOMATICALLY DISCONNECTED TO PROTECT FLUID LINES

For applications where fluid lines would otherwise be damaged by sudden strain, the Hansen coupling can be mounted in a stationary bracket to pull back sleeve and disconnect coupling instantly and automatically—leaving fluid lines free, positively sealed, and—undamaged.

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Useful Catalogs and Bulletins

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Nonflammable Hydraulic Fluid . . . A 12-page booklet describing in detail the properties and performance of Pydraul F-9, Monsanto Chemical Company's nonflammable-type hydraulic fluid, is available from the company. The fluid, developed primarily for use in such equipment as die casting machines, hydroelectric turbines, glass drawing machinery and hydraulic presses, is finding wide application in similar operations where a flammable pressure transfer fluid is a hazard. In addition to chemical and physical characteristics of Pydraul F-9, the booklet reports with charts and pictures on tests demonstrating the fluid's outstanding fire resistance, high lubricity, noncorrosiveness, chemical stability and excellent pumpability.

Circle 201 on Reader Service Card

Cylinders . . . "Use a Cylinder and Save a Man" is the title of Bulletin 152 published by Ledeen Mfg., Co. Twelve different applications of cylinder power are pictured and described, showing the versatility and simplicity of applying fluid power. Applied on special production machinery or to fixtures on an assembly line each ingenious use greatly simplifies construction and operation.

Circle 202 on Reader Service Card

Using Air Motors . . . Product engineers will find 26 original equipment application ideas for rotary air motors in Gast Manufacturing Corporation's Bulletin 449. This booklet is presented as an idea source. On its pages, you'll see brief stories about a variety of products. On each product, air is applied to do a new job, or do an old job better. Design features of the Gast air motor are emphasized by the use of a cutaway drawing. Sizes, types and capacities along with a long list of applications are presented.

Circle 203 on Reader Service Card

Rotating and Nonrotating Hydraulic Cylinders . . . Catalog 200, Section 3 presents complete data relative to Logansport Machine Company's most recent engineering developments on rotating and nonrotating hydraulic cylinders. The catalog provides you with the necessary technical and engineering data to enable you to determine the type and size of cylinders which most effectively meet your requirements. The 22-page catalog presents construction features and tabulated dimensional data for 8 different mounting styles of nonrotating cylinders.

Circle 204 on Reader Service Card

Teflon Packings . . . In a 48-page booklet, the United States Gasket Co. described their line of industrial gaskets and teflon products. Complete dimensional and application data is supplied for each product. Construction of their unique spiral wound gaskets is described. Properties and uses of teflon are charted and discussed.

Circle 205 on Reader Service Card

Limit Switches . . . For simple, versatile control of solenoid operated air and hydraulic valves you will want to be familiar with the use of limit switches. Square D Company has prepared a series of data sheets on their standard duty, machine tool type and small precision limit switches. Types of operating arms and arrangement of operating contacts are tabulated along with electrical ratings.

Circle 206 on Reader Service Card

Hydraulic Jacks . . . Complete information, including specifications and application data, on hydraulic jacks, is offered in a new Bulletin issued by Templeton, Kenly and Company. This 8-page folder, known as Hydraulic 50-R, contains photographs, detail drawings and tabulated data on hydraulic equipment in capacities of from 10 to 100 tons. Simplex Re-Mo-Trol pumps and rams are featured, including a full listing of accessories and attachments.

Circle 207 on Reader Service Card

"O" Rings . . . Precision Rubber Products Corporation has released a new 10-page folder, "Engineering Data on Army-Navy 'O' Ring Hydraulic Packings," which gives pertinent data covering "O" ring sizes, applicable groove dimensions, compounds and ordering suggestions for all Army, Navy and Air Force "O" ring specifications. It presents in simple charts all pertinent information regarding AN-6227B, AN-6230B, AF-934, AN-6290, MS-29512, AN-123586 through AN-124034, AX-1440 plus 38 additional compounds meeting various other military and AMS requirements.

Circle 208 on Reader Service Card

Filters for Hydarulic Systems . . . Complete engineering data on synclinal type filters for sump or line installation on all hydraulic and low pressure liquid recirculating systems is contained in a folder published by the Marvel Engineering Co. The Bulletin describes single unit capacity sizes available from 5 to 100 gpm. with a choice of filter mesh from 30 to 200.

Circle 209 on Reader Service Card

Agricultural Power Unit . . . The Char-Lynn Hi-Lo-Pac is fully described in an available parts specification sheet. This compact package, designed for the operation of farm implements, will deliver up to 10 gpm at pressures to 1,000 psi. The bulletin describes the reservoir, pump, valves and filter which make up the package. All operating characteristics are tabulated. An exploded view and complete parts list assists in the operation and care of this unit. Mounting kits for most tractors are described.

Circle 210 on Reader Service Card

Continued on page 110

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. . . in improving the efficiency
of machine tools, presses and other equipment that can't be replaced. Gerotor pumps are engineered for pressures up to 1000 p.s.i. continuous duty . . . in some sizes, up to 1200 p.s.i. continuous, 1500 intermittent.

GEROTOR

HYDRAULIC PUMPS

GEROTOR MAY CORPORATION, BALTIMORE 3, MARYLAND

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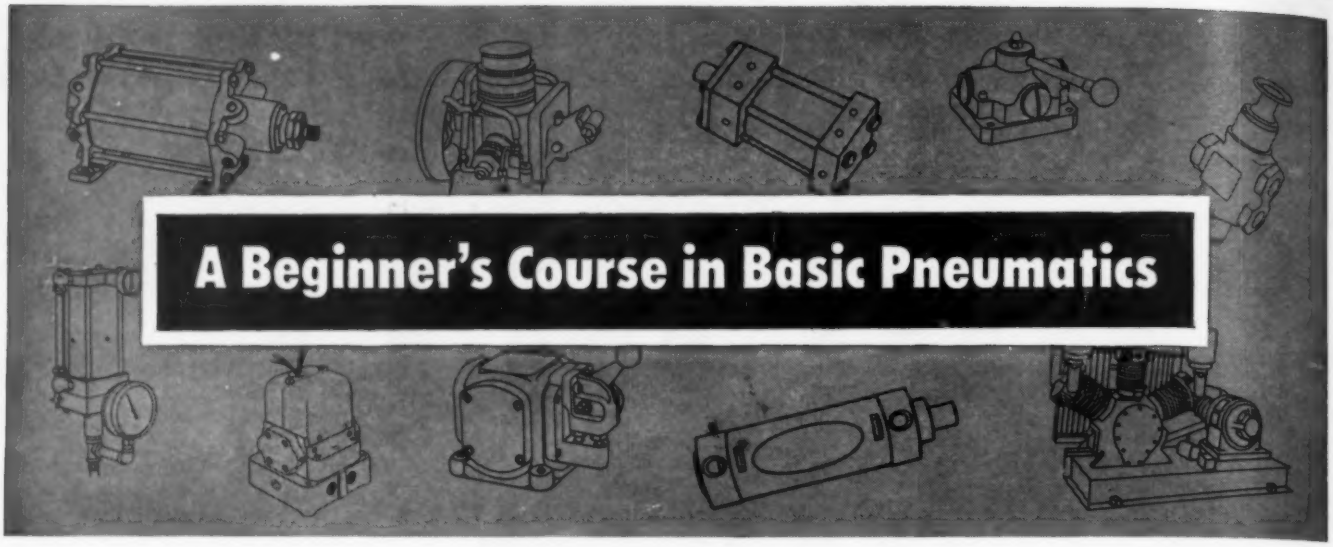

A Beginner's Course in Basic Pneumatics

Section I

Air Properties and Characteristics

Part II

IN this series we will touch only incidentally on pneumatic aircraft conponents and their applications to the operation, actuation or control of airplane power services. The reason is that aviation pneumatics is a specialized and, in many cases, a highly developed branch of the art, and our purpose is to stay close to the fundamentals. However, with a sound basis of understanding of the principles of pneumatics and the operation of the basic components, aviation pneumatics can be readily understood and the thinking behind the special equipment can be intelligently followed.

Compressed air as a power source has been used in airplanes for a long time. However, until recently, pneumatically operated services were essentially restricted to emergency or auxiliary systems such as landing gear or brakes. Late in the last war the rapid opening and closing of bomb bay doors was done by pneumatics. This development was a high priority emergency since enemy anti aircraft fire was systematically withheld until the bomb bay doors started to open, marking the "home" level run over a target. Since many bombers were lost as a result of this type of concentration of fire, it was imperative that the doors be operated much faster. A pneumatic system cut the time to open the doors from 30 seconds to approximately 5 seconds.

As Ralph Middleton pointed out (APPLIED HYDRAULICS, January 1952) the single greatest advance in the application of compressed air to aircraft power services has been the development of efficient, lightweight compressors designed to operate at a maximum working pressure of 3000 psi. Compressors capable of delivering up to 5 cubic feet of free air per minute without supercharging at sea level are now in service. Service specifications call for compressors discharging at both 1500 and 3000 psi.

Working Pressures

The most distinctive difference between industrial and aviation compressors is the discharge or working pressures. The great majority of industrial compressors deliver air at pressures from 80 to 125 psi for working pressures of 60 to 100 psi; the aviation compressor delivers air at 1500 or 3000 psi for services requiring these operating pressures.

In addition to compressors which compress air for performing a unit work function, e.g., the operation of a cylinder, other types (usually impeller type) are used for providing compressed air at a lower pressure for pressurization of aircraft cabins, air conditioning and refrigeration systems for airplanes, cabin pressure regulators and other units for controlling the flow of air. These compressors

for

Exacting

CYLINDER CONTROL

¼" UNITITE JR. VALVES

Hanna ¼" Valves control air, oil or water pressures up to 500 p.s.i. The control lever requires only 80° movement for reversal. Hanna ¼" Valves are 4-way but can be made 3-way, by plugging one port. Three models—column, standard and manifold mount—are available. Ideal for tubing and light piping.

ELECTRIC VALVES

The Hanna 4-way Solenoid Valve is small, compact, with low current consumption. It is adaptable to straight line piping—capacity is equal to rated pipe size. Of balanced spool type, it has a built-in solenoid pilot valve. Piping may be from bottom, sides or a combination. Available in ⅜", ½", ¾" and 1" pipe sizes.

Hanna® valves

CHOOSE FROM a broad selection of Hanna Valves to meet your requirements for exacting Air and Hydraulic control. Illustrated are but a few of the complete line of hand, foot, electric and pilot operated valves for directional and speed control. They all carry the Hanna nameplate—an assurance of extraordinary care in design and manufacture—which means years of maintenance-free operation. Your Hanna sales representative offers specialized experience in selecting valve combinations and developing control circuits.

SPEED CONTROL VALVES

Hanna Flo-Set Valves have micrometer graduations to assure exacting speed control. Available in ¼", ⅜", and ½" sizes, they are suitable for air, oil or water control, with maximum pressure to 250 p.s.i. They may be mounted in any position.

UNITITE VALVES

Unitite Valves are suitable as either 3-way or 4-way valves, operating at air, oil or water pressures up to 250 p.s.i. for the ⅜", ½", and ¾" sizes . . . up to 150 p.s.i. for the 1" size . . . and up to 100 p.s.i. for the 1¼" size. Three styles—for standard mounting, column mounting or manifold mounting —are available.

Send for Catalog

Hanna Valve Catalog No. 254 includes descriptions and specifications on the complete line.

FOOT OPERATED VALVES

Available in ⅜", ½", ¾" and 1" pipe sizes, Hanna Foot Valves are ideal for applications where it is desirable to have the operator's hands free for handling material. Single-pedal and double-pedal models, for pressures up to 250 p.s.i., are available for use with double-acting air and hydraulic cylinders.

Hanna Engineering Works

HYDRAULIC AND PNEUMATIC EQUIPMENT . . . CYLINDERS . . . VALVES . . . RIVETERS

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Circle 41 on Reader Service Card

Advantages of Compressed Air for Aviation Applications

1. *Small, light power source and compressor are capable of operating relatively large intermittent power service requirements*
2. *Low weight of fluid*
3. *Inexhaustible fluid supply*
4. *Low weight of working and control components*
5. *Ease of safe storage for instantaneous use*
6. *Weight saving of small pneumatic transmission lines (and no return lines)*
7. *Development of fast, reliable and practically (or actually) leakproof cylinders and valves*
8. *High degree of system accessibility for maintenance and unit replacement for service (no refilling or bleeding of lines)*
9. *Operation practically independent of ambient temperatures*
10. *Large safety factor—no fire and minimum explosion hazards*
11. *With ground charging, there is no power drain at take off*
12. *Less vulnerable (military airplanes) due to smaller and fewer lines.*

Disadvantages of Compressed Air for Aviation Applications

1. *Weight factor limits compressed air to use as intermittent power service*
2. *Weight penalty of necessary auxiliary equipment (aftercoolers, moisture removers, filter-lubricators, air bottles, etc. Air bottles are the chief weight penalty, which can be overcome in some cases by the use of structural parts, e.g., landing gear struts)*
3. *Low inherent efficiency of a compressed air system*
4. *Leakage in transmission lines*
5. *Relatively few sources of approved pneumatic equipment*

are called superchargers. However, these should not be confused with superchargers for engines. There is a rough parallel of engine supercharger and pressurization supercharger to industrial or process air conditioning and comfort air conditioning.

Turbo Compressors

Another development in aviation compressors is the high speed turbo compressor, operating at relatively low pressures but at a high rate of flow. The turbo compressor and turbine is finding many new applications on airplanes and guided missiles for specialized power services. With both high pressure and low pressure air available, the airframe designer has been able to add progressively to pneumatic power services, e.g., low pressure for operating cockpit canopies and door latches, high pressure for actuation of landing gear, brakes, bomb bay doors, gun turret rotation and elevation, ramp and cargo loading devices.

Fig. 1. High capacity pneumatic compressor for aircraft use delivers two cubic feet of free air at 3000 psi delivery pressure.

Photo courtesy The Cornelius Co.

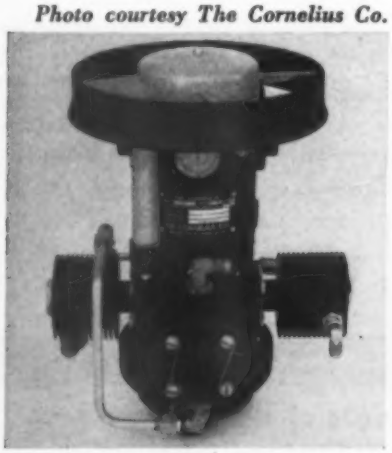


Fig. 2. Radial four cylinder, four-stage piston type compressor delivers four cubic feet of air per minute at 3000 psi (sea level).

Photo courtesy Walter Kidde & Co., Inc.

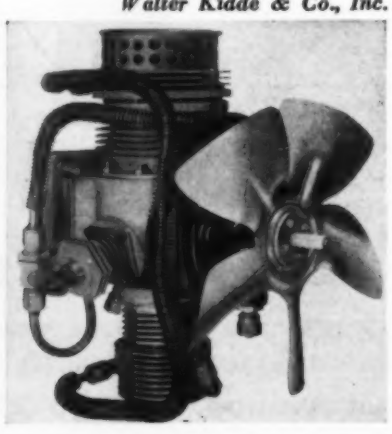


Fig. 3. A pilot operated piston type pneumatic pressure reducing valve for 3000 psi supply service.

Photo courtesy Westinghouse Air Brake Co.

The principal refrigeration function on modern high speed airplanes, especially jet aircraft, is to dissipate the heat caused by surface friction. Surface temperatures up to 600 F are generated at top operating speeds. Air expansion cooling turbines, with heat exchangers, are used to cool temperatures down to 30 F for cockpit comfort.

Some aviation compressors are designed for engine mounting. Others are designed for drive by either electric or hydraulic motors. The intensive program of the flying Services for light, weight, higher efficiency compressors is beginning to bear fruit. Several approved aviation compressors are now being supplied in production quantities.

Size and Weight Factors

Perhaps the most important distinction between pneumatic units and components used in modern military and commercial airplanes and those used in industry is in size and weight. With a high premium on weight saving, the airplane builders and their designers insist upon the smallest and lightest components and units capable of reliable performance. In addition to the modern aviation compressor, this has stimulated special designs of cylinders, valves, air bottles and other accessories of pneumatic systems. Some valves, for example a directional valve, may be so different in size and appearance from a directional valve used for a comparable function in an industrial circuit that a service man, accustomed to industrial valves, probably would not even recognize the aviation valve.

The weight saving restriction actually involves important other factors and characteristics. The strength of materials for valve stems and bodies, types of packings and lubricants, tolerances and fittings of parts usually are peculiar problems to aviation components. More rigid design and performance, as evidenced by qualification tests, are required. Important too, is the much higher costs of aviation pneumatic components.

There is an important cross relationship of pneumatic units and components designed and built for aviation use with those designed and built for industrial use. In industrial applications, mere weight is of little or no consequence. As a result cylinders and valves, for example, are normally big and heavy, tolerances are wider, non-working surfaces are left with rough finishes and the choice of materials is often not critical. Many of the aviation components have had an accelerated development, stimulated by special development contracts. As a result, the research and test work on aviation components has produced units of high efficiency and advanced design. The builders of industrial valves have profited by the aviation design progress in many cases and they will continue to profit.

From our overall point of view, the accelerated development of aviation pneumatic components and units functions as an advance guard for the much wider group of industrial component manufacturers.

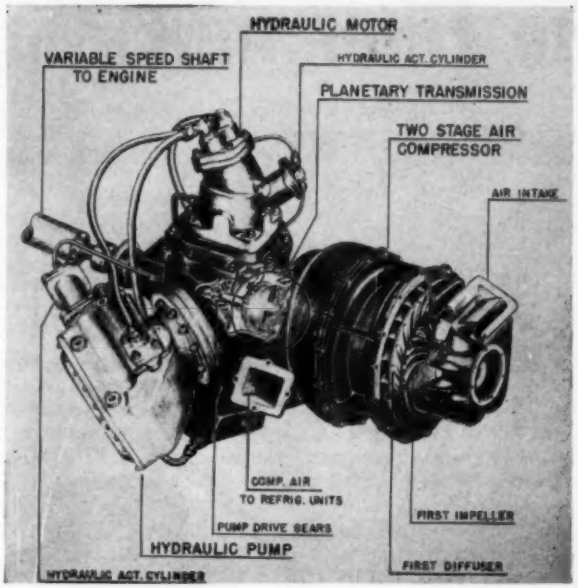
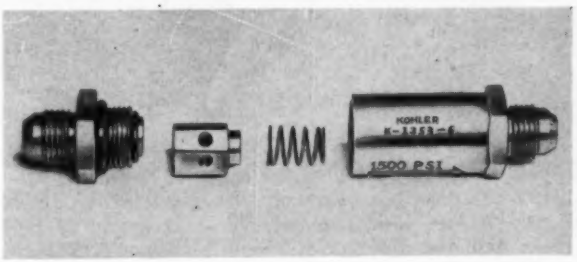


Photo courtesy Compressed Air and Gas Institute

Fig. 4 This cabin supercharger, a two stage air compressor, integral with its take off and hydraulic drive, is typical of the low pressure pneumatic power system utilized as an auxiliary power source for modern aircraft. The AiResearch Manufacturing Co.'s supercharger shown is a completely packaged power plant.

Fig. 5. An exploded view of a 5000 psi pneumatic check valve.

Photo courtesy Kohler Company

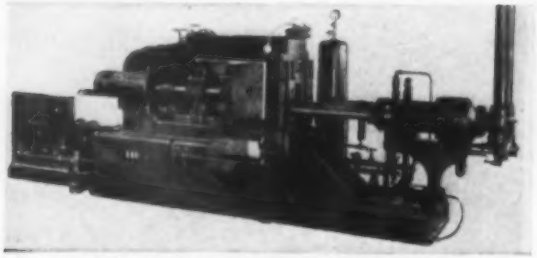


Pneumatic Characteristics Meet Many Requirements

There will be cases where compressed air should not be used for aviation power services. Impartial engineering analysis may definitely point toward some other type of power source. However, pneumatics can and should be considered when the inherent characteristics of a pneumatic solution meets a given set of requirements. One of our purposes will be to present the basic advantages of the pneumatic component, cir-

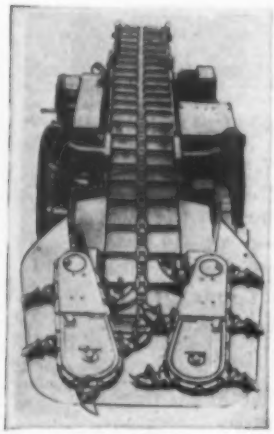
Concluded on page 107

The Filter that Manufacturers Specify—



DIE CASTING MACHINE. Lester Phoenix, Inc., Cleveland, O.

DRILLING RIG. Emsco Derrick & Equipment Co., Los Angeles, California



UNDERGROUND LOADING MACHINE

The Clarkson Mfg. Company
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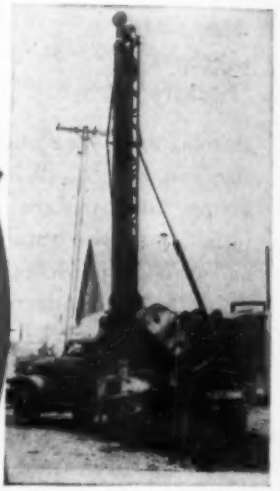
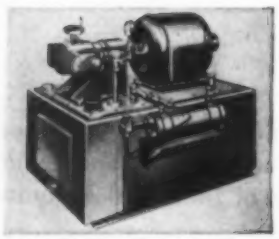


HOLE DIGGER

Hugh B. Williams Mfg. Co.
Dallas, Texas



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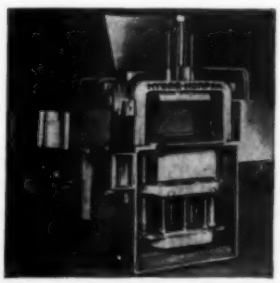

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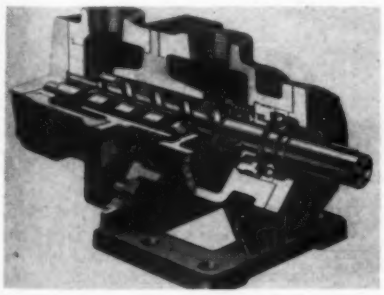
application and performance of NEW COMPONENTS

AIR POWERED DRILLING DEVICE—A new and unique drilling device will be introduced this month by the Bellows Company. The new unit, named the Hydrair is electrically controlled, but air powered with the feed rate hydraulically controlled. Drilling capacity is ¼ in. with maximum depth of stroke 4 in. The Hydrair features rapid advance, controlled feeding through the work and rapid return. All controls are built in. Standard spindle rated free speed is 28 rpm, rated hp ¼, developing a maximum of approximately 1/3 hp at 1500 rpm. Five additional optional speed ranges are available to make the unit adaptable to widely varying materials. Feed rate is adjustable from zero to 200 ipm at 90 psi air pressure.

The Bellows Company

Circle 151 on Reader Service Card

IMO PUMP FOR HIGHER PRESSURES—A new De-Laval IMO A313B pump, which saves up to 40 percent in initial cost over other IMO models for similar pressures, has been introduced by De-Laval Steam Turbine Company. This pump is designed to handle a wide variety of oil handling applications for pressures up to 275 psi. This positive displacement pump has only three moving parts. It is quiet, pulsation-free, compact, excellent for high-speed operation. It can be used for capacities to 80 gpm, pressures to 275 psi and intermittent pressures up to 325 psi.



De Laval Steam Turbine Company

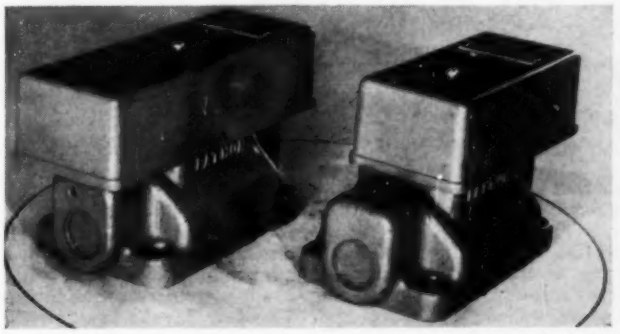
Circle 152 on Reader Service Card

LARGE HP ELECTRIC MOTOR—The Industrial Motor Division of Robbins & Myers, Inc. has added four frame sizes to its line of standard motors to include 125 hp ratings. The four new sizes are designed for all-weather operation, with special treatment to resist moisture and corrosion. All steel parts have a baked-on rust-resisting undercoating. The rotor assembly is treated with a special rust-inhibitor and the cast-iron end-heads and terminal box are cleaned and given an anti-corrosion treatment of zinc chromate. Power lead-ins are sealed at the motor shell with a non-hardening compound. The four new ratings will be made in NEMA frames 444, 445, 504 and 505.

Robbins & Myers, Inc.

Circle 153 on Reader Service Card

HYDRAULIC DIRECTIONAL VALVES—A completely new line of 3- and 4-way hydraulic valves have been introduced by Pathon Manufacturing Co. This line includes solenoid operated, pilot operated, and solenoid controlled pilot operated valves. These units, of the subplate mounted type, are extremely compact and streamlined in appearance. The comparatively small size, together with subplate mounting and low solenoid amperage requirement, provides a unit which well compliments modern machine design. Three sizes are presently available: to handle 1, 18, and 48 gpm. A variety of porting arrangements are available.



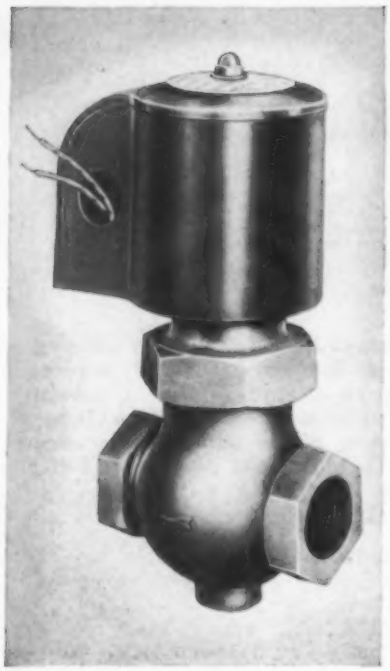
Pathon Manufacturing Co.

Circle 154 on Reader Service Card

INTENSIFIERS—Pictured here are 6000 psi intensifiers manufactured by the Columbiana Engineering Company. These intensifiers which were specially built to test processed coiled or straight tubing can be applied to many applications. By using 300 psi air on the large 9 in. bore cylinder, 6000 psi pressure results on the small 2 in. cylinder. Water is used for the testing medium.

Columbiana Engineering Company

Circle 155 on Reader Service Card

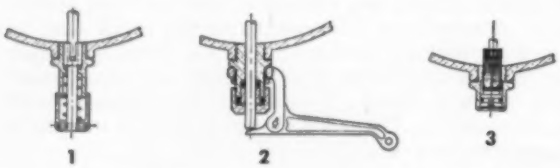


Bulletin 8210

General Purpose Control Valves

- ★ Full Port Area—Packless
- ★ For Air, Gas, Water, Brine, Freon, Methyl Chloride, Light Oil and other Liquids and Gases up to 212°F; Pressures up to 400 pounds
- ★ Several Auxiliary Variations
- ★ Several Sizes: ½ to 2½ inches

Our Bulletin 8210 Solenoid Valves are designed for those shut-off requirements where a simple, rugged, automatic control will serve. They close instantly when current to the coil is cut off. Full line pressure on top of the valve piston aided by a powerful spring assures tight closing. They reopen fully when the coil energy is restored. Only minimum current is required because the solenoid, when energized, is required to open only the small pilot port against the line pressure. The construction is such that the valve is held open by the solenoid for full pipe area independent of the flow through the pipe line.



Three auxiliary variables are available: (1) device for locking the valve in open position; (2) device for utilizing the valve for whistle control; (3) by-pass adjustment for holding the valve open.

Bulletin 8211 Valves are similar except that they have Explosion-Proof Solenoids approved by Underwriters' Inc., Class 1, Group D, Hazardous Location.

If you have any automatic control problems that fit into the above class, you might study fully the merits of Asco Bulletin 8210 and 8211 Solenoid Valves. Write us anyway, regardless of your problems, because we have many other types of solenoid valves.

ASCO Solenoid VALVES

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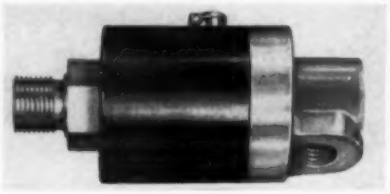
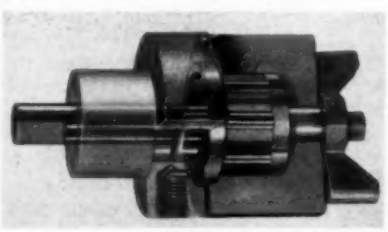
ROTATING AIR UNION—Deublin Company has introduced a rotating air union, model 1105, featuring a new method of balanced sealing and easy maintenance. The balanced sealing feature prevents line pressures from increasing the load on the sealing faces, minimizes wear, and permits a predetermined low torque. Micro-lapped faces of Graph-Mo tool steel and carbon form the leak-proof seal. Model 1105 is available in two types: standard shaft mounting type, and special "in-the-shaft" mounting type which reduces overhang. Maximum operating speed is 3500 rpm. Maximum air pressure is 150 psi.



Deublin Company

Circle 156 on Reader Service Card

COMPACT PUMP—Milwaukee Hydropower, Inc. has brought out the new Magna-Mite, a low-priced positive displacement pump. With a capacity from 1½ gpm down to ¼ gpm or less, this pump is suitable for handling light hydraulic fluids. It is similar to vane-type pumps in operation and construction, but has an important



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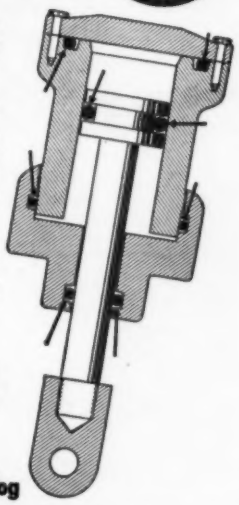

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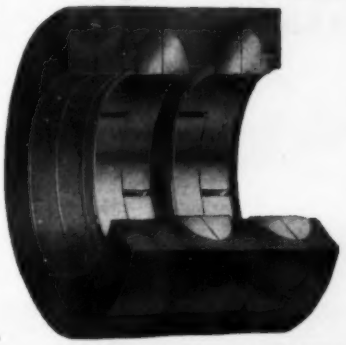

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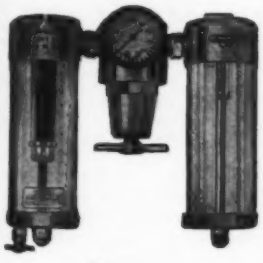

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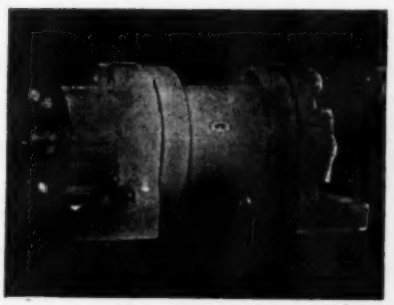
Air — Oil — Water



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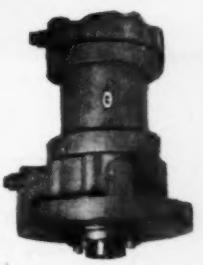

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Prompt Deliveries

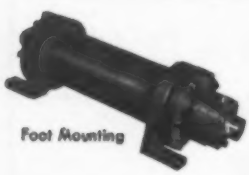
NEPTUNE-POWER PLUS PRODUCTS Company
2228 Bellevue, Detroit 7, Michigan

Circle 72 on Reader Service Card

POWER...

- ECONOMICAL
- RUGGED
- VERSATILE

LINDBERG AIR & HYDRAULIC CYLINDERS



For Pulling—Pushing—Lifting—Forcing—Clamping—Pressing

Whether it's one of the 12 standard bore sizes in one of the seven mounting types — or a special cylinder built to your specifications — there's a Lindberg Air or Hydraulic cylinder for your specific need.

Remember — Lindberg cylinders effect great savings through the reduction or elimination of costly mechanisms formerly needed for a variety of power purposes — and their adaptability and ruggedness makes them useful for many industrial purposes.

WRITE FOR BULLETIN 731

Visit the Lindberg Booth #1333, 1952 ASTE Industrial Exposition, Chicago Amphitheatre, March 17-21.

LINDBERG AIR & HYDRAULIC CYLINDERS

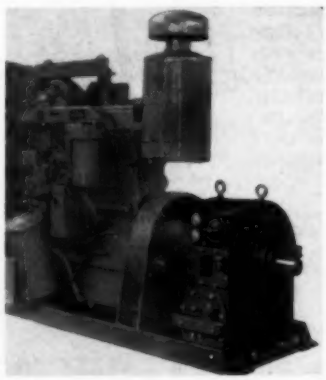
Lindberg Engineering Company, 2441 W. Hubbard Street
Chicago 12, Illinois
Circle 59 on Reader Service Card

difference in that the conventional vanes are replaced by rollers. The rollers contact the outer case as in a roller bearing, and rolling friction replaces sliding friction between the vanes and the pressure chamber. As a result, the life of the pump is increased three to five times over that of ordinary type vane pumps. The action of the rollers against the inner periphery of the pressure chamber induces the formation of an oil wedge between the contacting surfaces to insure proper lubrication at this point. Vanes are hydraulically balanced. The size and shape are especially practical for applications where space is at a premium.

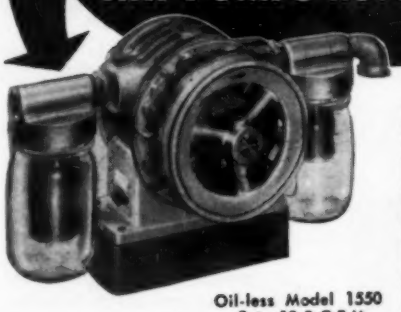
Milwaukee Hydropower, Inc.

Circle 157 on Reader Service Card

TORQUE CONVERTER—The Torcon Corporation has added a new Model 17-K single-stage, three-element type unit to the standard line of Torcon torque converters. Combining a hydraulic coupling in a single unit, it provides superior automatic transmission for shovels and cranes, oil well rigs and rail and road machinery. This model can be used with engines up to 300 hp. The converter has a variable torque ratio up to 3:1. At zero output speed, the torque multiplication is highest and this gradually decreases with increasing output speed until a point is reached where the output and input torque are equal. Because the engine performs



FORGET THE OIL!
GAST rotary Oil-less AIR PUMPS never need it!



Oil-less Model 1550 — 8 to 10.5 C.F.M.

Below — Oil-less 3040, end plate removed. From 17 to 24 C.F.M.

See our CATALOG in SWEET'S FILE for PRODUCT DESIGNERS

Write for new Data Sheet on Oil-less Pumps, showing three types and rating tables.

THEY RUN ENTIRELY *without oil* in pumping chamber. Carbon rotor vanes lubricate themselves — through thousands of hours' use. Ball bearings grease-sealed for life. You can forget oiling problems!

DELIVERS ABSOLUTELY OIL-FREE AIR. Your product or material can't be contaminated with oil droplets.

FOR BOTH VACUUM AND PRESSURE, Gast Oil-less Models are precision-built for dependable high performance. Sizes from 3.5 to 24 C.F.M., 3 to 10 lbs. pressure, 10 to 20 in. vacuum.

Original Equipment Manufacturers for Over 25 Years

GAST ROTARY — AIR MOTORS · COMPRESSORS · VACUUM PUMPS
(TO THREE H.P.) (TO 30 LBS.) (TO 28 INCHES)
GAST MANUFACTURING CORP., 131 Hinkley St., Benton Harbor, Mich.

Circle 34 on Reader Service Card

Not One at a Time But All At Once

Here's how one motor manufacturer simplified an assembly operation

Formerly, it was like putting on a glove—in sections. Seven separate synthetic rings had to be inserted in 7 ports in the hydraulic control mechanism, the heart of the automatic transmission.

The obvious answer called for a synthetic rubber gasket with the 7 square-shoulder rings molded integral with a wide flange, and located exactly opposite each port — so that all seven rings could be installed simultaneously.

Producing this special packing, with a wide flange held to .030" ± .005", was one of those "impossible" molding operations that merely takes a little longer.

The result is a typical example of how G&K-INTERNATIONAL engineering and manufacturing are helping industry solve problems in pneumatic and hydraulic packings applications.

Photograph shows molded gasket enlarged about 30%

second century G and K – INTERNATIONAL

GRATON AND KNIGHT ESTAB. 1851

Leather and synthetic packings

GRATON & KNIGHT COMPANY
Worcester 4, Mass.

INTERNATIONAL PACKINGS CORPORATION
Bristol, New Hampshire

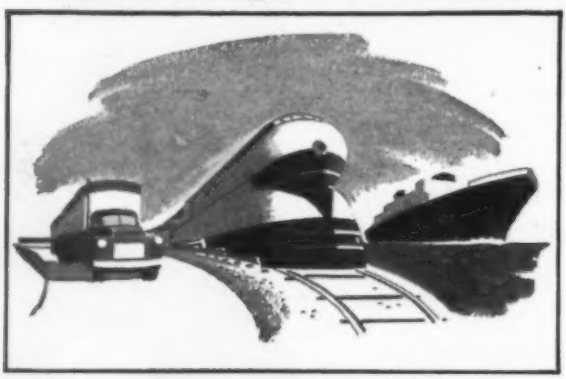
Circle 38 on Reader Service Card

Bendix-Skinner

ORIGINATOR OF **MICRONIC** FILTRATION

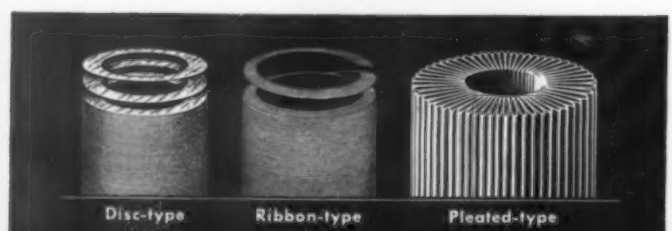
the *Finest*

Answer to Any Filtering Problem



For over twenty years ***Bendix-Skinner*** has specialized in solving the filtering problems that "couldn't be done." From this experience has come entirely new and exclusive filtering techniques which do even the work-a-day filtering jobs better and at lower long-range cost. Tell us about *your* problem—nine times out of ten ***Bendix-Skinner*** filters will supply the "finest" answer.

***Over 350 Models** providing filtration from ½ micron (.000019") upwards at flow rates from 1 to 5000 g.p.m.*



Disc-type Ribbon-type Pleated-type

SKINNER PURIFIERS DIVISION OF

1503 TROMBLY AVENUE,
DETROIT 11, MICHIGAN

Bendix AVIATION CORPORATION

Export Sales: Bendix International Division, 72 Fifth Ave., N. Y. 11, N. Y.

Circle 97 on Reader Service Card

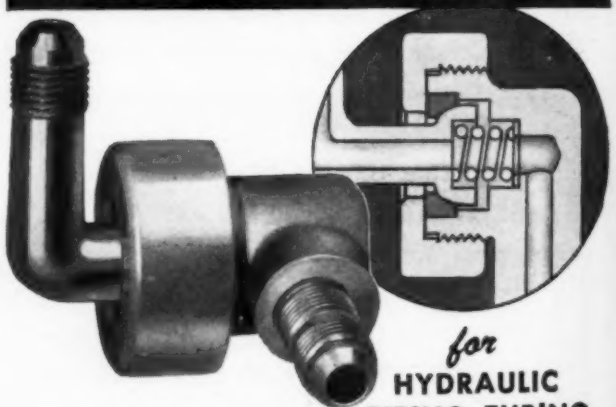
at a practically constant speed during the converter range, overload will not cause stalling. When the torque ratio reaches 1:1, the reaction member is free wheeled and the unit acts as a hydraulic coupling. In the coupling range, output speed increases in nearly direct proportion to engine speed.

The Torcon Corporation

Circle 158 on Reader Service Card

"STELLITE" WELDED SOLENOIDS—The 3K-300 saddle stop type solenoid offered by National Acme Co., introduces a leather faced retainer stop and hood, so arranged as to act as guide and a silencer to the plunger movement. Design is compact yet simplified, making it easy to change coils to accommodate different voltages and frequencies. This 3K-300 series retains the featured "Stellite"-Weld, bonding of laminations of the plunger at the sides and point of impact. Its new features further improve adaptability and appeal especially to manufacturers whose application requires the elimination of noise and freedom from contamination. Va-

LEAKPROOF! NO BINDING!



for **HYDRAULIC PIPING, TUBING**

BARCO *High Pressure* **SWIVEL JOINTS**

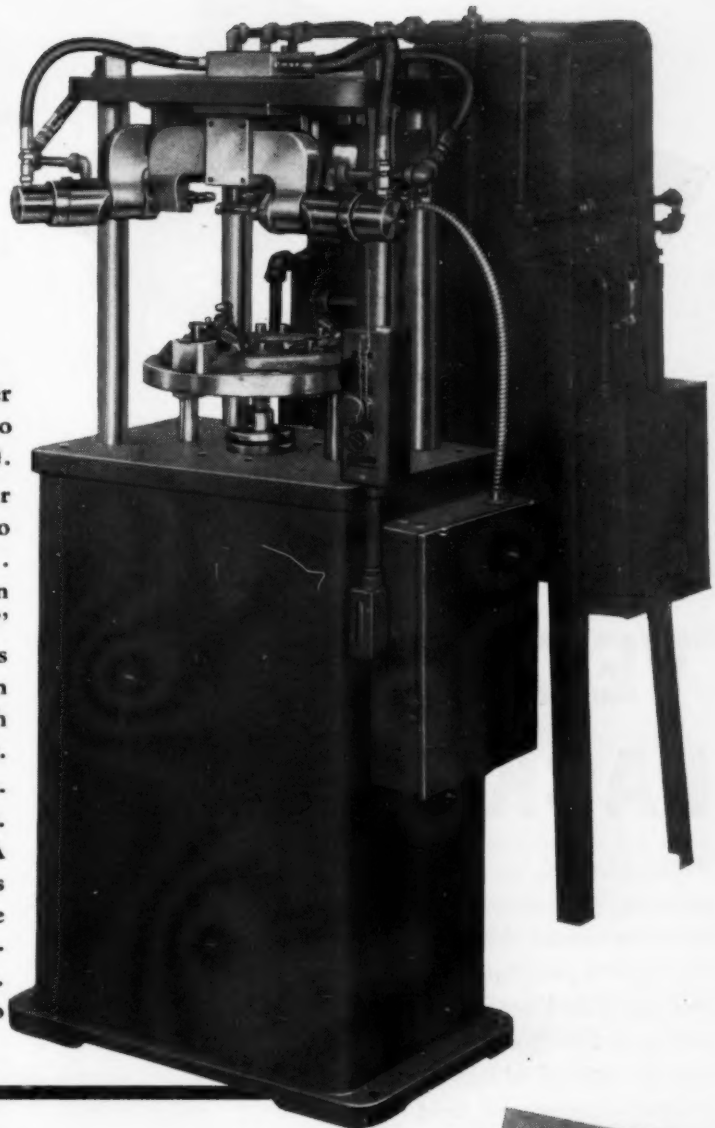
WHEREVER hydraulic piping or tubing must move, use Barco Swivel Joints! Barco's exclusive design provides *side flexibility* to allow for piping misalignment and to PREVENT BINDING. *Only Barco offers this important advantage.* Widely used for making compact, low torque swivel connections to reciprocating or rotating parts. Ends the nuisance of sagging, flopping non-rigid lines. LEAKPROOF; SAFE! Suitable for extremely high or low temperatures. Ratings to 3,000 psi, or higher. Choice of styles, ⅛" to 2", angle or straight. *Ask for Bulletin 265.* BARCO MFG. CO., 1832 D Winnemac Ave., Chicago 40, Ill. *In Canada:* The Holden Co., Ltd.

Circle 12 on Reader Service Card

THIS PRESS STAKES 3 PINS

SIMULTANEOUSLY

AT 3 DIFFERENT ANGLES!

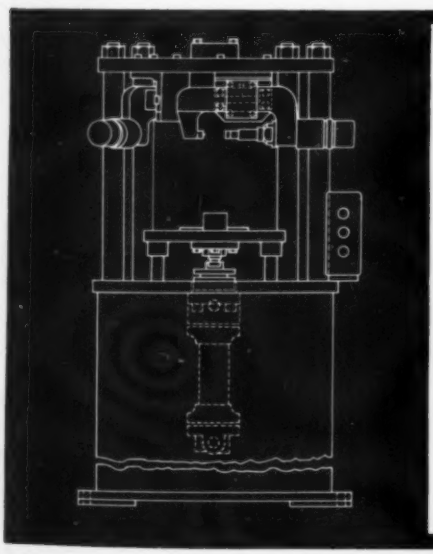


What Does This Suggest to You?

Tool engineers for a large automotive parts manufacturer utilized standard Hannifin "Hy-Power" components to build this special high-production machine (see below).

"Hy-Power" Hydraulics may be the answer to your problem, too. For here is equipment that permits you to apply forces up to 100 tons at any angle you want . . . permits you to punch, rivet, stake, crimp or bend in *two or more planes simultaneously*. Compact "Hy-Power" high pressure cylinders exert the force. The source is the Hannifin "Hy-Power" Generator . . . a combination of motor, pump, oil reservoir, control valves and high pressure intensifier assembled as a compact, single unit.

Hannifin "Hy-Power" Hydraulics has brought production economies to manufacturers in many fields. Why not explore the possibilities it holds for you? A Hannifin Field Engineer will discuss with your engineers how you can incorporate this modern equipment in the machines you build, whether they are one-of-a-kind specials or machines to be built by the hundreds, for resale. Hannifin Corporation, 1155 S. Kilbourn Ave., Chicago 24, Illinois.

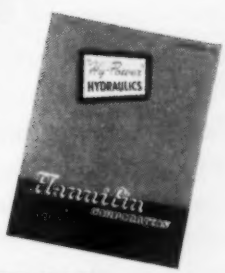


THE PROBLEM:

To stake the three pivot pins, located 120° apart, which hold the actuating fingers of a clutch pressure plate.

THE "HY-POWER" SOLUTION:

Three 7½-ton "Hy-Power" cylinders were installed and positioned to stake the three pins simultaneously. Clutch plate, fingers and pins are placed in fixture. A button is pressed, a standard Hannifin cylinder raises the fixture to position, and the three pins are staked—*automatically, simultaneously*. The fixture returns to its original position automatically, for unloading and reloading.



WRITE FOR BULLETIN 150

This book belongs in your files. A copy, telling the complete story of Hannifin "Hy-Power" Hydraulics, will be sent on request.

do ALL you CAN do . . . with

HANNIFIN

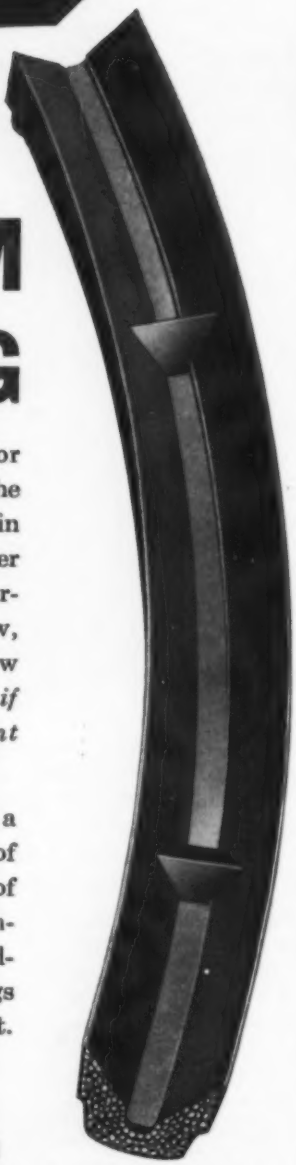
Air and Hydraulic Cylinders • Hydraulic Presses • Pneumatic Presses • "Hy-Power" Hydraulics • Air Control Valves

Circle 43 on Reader Service Card

POSITIVE SEALING PROBLEMS

LINEAR

*VEE-DAM PACKING



From LINEAR, long known for superior "V" Rings, comes the most important development in mechanical packings in a quarter century! VEE-DAM Rings—different, revolutionary—give new, positive control of labyrinth flow or lateral passage of fluid *even if shrinkage should cause joint separation!*

VEE-DAM Rings now permit a positive seal, even though gaps of 1/8" or more exist between ends of the rings. With this new circumferential sealing method, the advantages of solid ring packings over split packings no longer exist.

SEND FOR FULL INFORMATION

Field-tested and proven, VEE-DAM fabric reinforced "V" Rings can effect improvement and economy in your applications. Write for free bulletin and data.

*Patent applied for

"PERFECTLY ENGINEERED PACKINGS"

LINEAR

LINEAR, Inc., STATE ROAD & LEVICK ST., PHILADELPHIA 35, PA.

Circle 60 on Reader Service Card

riety of strokes: 1/4, 5/16, 3/8, 1-1/2. Pounds push or pull: 2-1/2 to 14. Current: AC or DC. Mountings: base or side. These solenoids are furnished standard or specially engineered to unusual application.

The National Acme Company

Circle 159 on Reader Service Card

CONTROL UNIT FOR HYDRAULIC PRESSURE—

A newly developed model 140-X Robotron control unit designed by Emmett Machine & Manufacturing, Inc. performs automatic bumping operations on hydraulic presses. This control unit can be set to give from 1 to 40 bumps during any one cycle of operation as well as to control the overall cure time. It is equipped with three built-in time arrangements, any one of which can be selected by the "flick" of a switch. The unit is wired for use with limit switches to regulate the amount of press opening during the bumping operation, to close the press after a predetermined time, and to hold the press closed until the next bump. Robotron is particularly suitable for use where remote control of any hydraulically operated press is desirable.

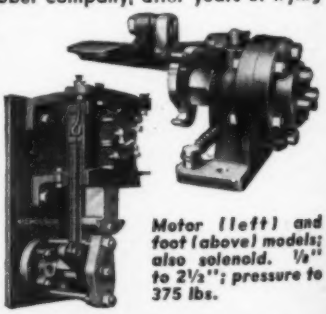
Emmett Machine & Manufacturing, Inc.

Circle 160 on Reader Service Card

Leading Processor's Tests Prove

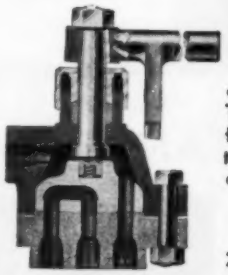
Nicholson Valves Improve With Use

Nicholson control valves were recently adopted as standard by a well-known rubber company, after years of trying practically all makes. Their capacity for longer leak-free service is confirmed by many installation records which show Nicholson valves actually become tighter with use. This is because their non-corrosive flat discs tend to lap themselves on the seats. For all mediums and types of operation.



Lever models (below), 1/4" to 2 1/2", pressure to 5000 lbs.

Motor (left) and foot (above) models; also solenoid. 1/8" to 2 1/2"; pressure to 375 lbs.



CATALOG 1250

213 Oregon St., Wilkes-Barre, Pa.

W. H. NICHOLSON & CO.

TRAPS · VALVES · FLOATS

Circle 74 on Reade Service Card

HYDRAULIC TEST STANDS — Illustrated is a hydraulic test stand designed by Superdraulic Corporation for testing flexible hose used in aircraft. With variations, this same stand can be adapted to the testing of valves, cylinders and other equipment. Superdraulic Corporation engineers, fabricates and assembles all types of test stands employing hydraulic pressure. These stands include pumps, relief valves, oil reservoirs, electric motors, flexible couplings, and incidental valving and piping to meet specific test purposes. These test stands are built to provide test pressure up to 5000 psi using large volume pumps and up to 30,000 psi using special boosters.

Superdraulic Corporation
Circle 161 on Reader Service Card

HIGH ACCURACY TACHOMETERS—Extremely high accuracy, .25 percent of any speed being measured is guaranteed with new Metron tachometers. Ideal for turbine overspeed tests, production motor test stands, dynamometer test stands, laboratories, and similar precision speed measuring applications. Ten overlapping and adjoining ranges, instantly selected by rotary switch, provide more than a 10 to 1 spread in speed. The indicating meter has three scales selected for good readability of minor divisions in integral numbers. Speeds of 36 to 100,000 rpm are easily covered by three models.

Metron Instrument Company
Circle 162 on Reader Service Card

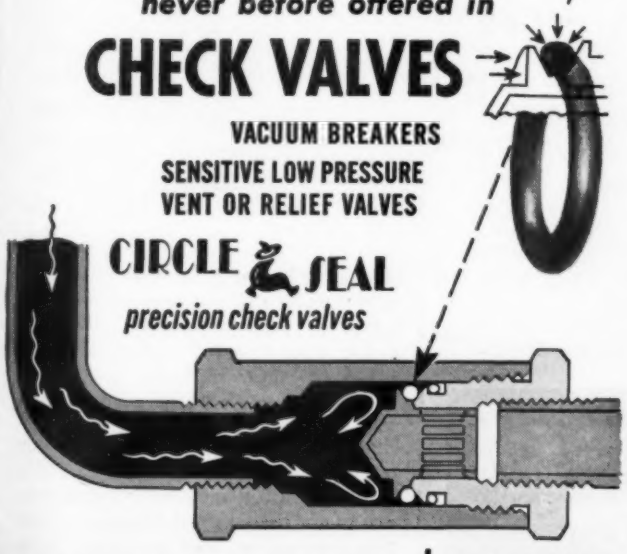
the circle seal principle

provides sealing assurance never before offered in

CHECK VALVES

VACUUM BREAKERS
SENSITIVE LOW PRESSURE
VENT OR RELIEF VALVES

CIRCLE SEAL
precision check valves



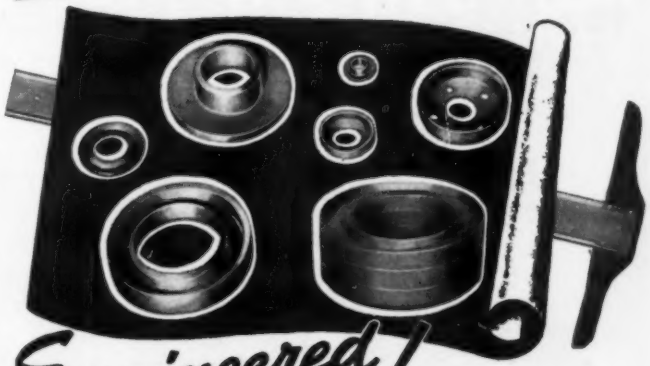
JAMES-POND-CLARK

1247 East Green Street, Pasadena 1, Calif.

Engineering data sent free of charge on request.

Circle 52 on Reader Service Card

Chicago Belting LEATHER PACKINGS



Engineered!

Our Packings are Recognized

"THE WORLD'S FINEST"

For Three Important Reasons:

1. QUALITY LEATHERS

Only the finest quality leathers obtainable are used. The selection and treatment of the proper leather is made in our chemical laboratory — here break-down and service tests determine the BEST leathers for the many different service conditions.

The excellence of our chemical and physical analysis enable us to consistently produce SUPERIOR packings.

2. TO SPECIFICATION

Scientifically constructed to proven modern packing design using the best manufacturing methods. Built to exacting dimensions — especially processed for vacuum, air, oil and hydraulic service. Production controlled with the skill gained from many years of experience.

3. PERFORMANCE

Engineered to operate with highest efficiency in all mechanical applications. All our leather packings are UNIFORMLY dependable with longer service life built into each packing.

Send now for your free copy of our 64 page book on HYDRAULIC and PNEUMATIC LEATHER PACKINGS.

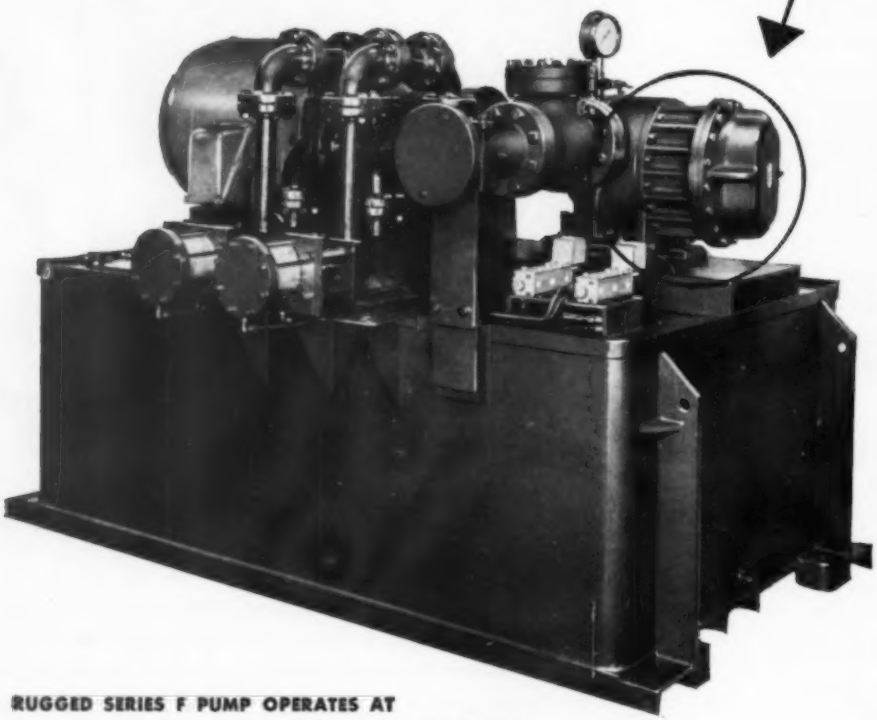
WE MANUFACTURE ALL THE CONVENTIONAL LEATHER PACKINGS, ALSO MECHANICAL LEATHERS, COUPLING DISCS, GASKETS, WASHERS, ETC

CHICAGO BELTING COMPANY
Manufacturers of Leather Belting and Mechanical Leathers
111 NORTH GREEN STREET • • • CHICAGO 7, ILL.

Circle 21 on Reader Service Card

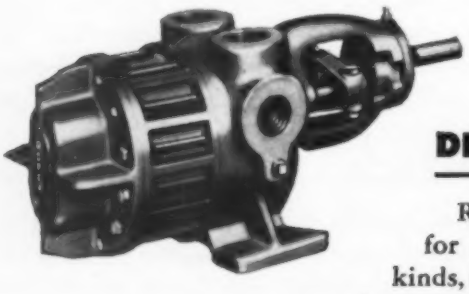
IT'S ROPER

for HEAVY DUTY Hydraulics



RUGGED SERIES F PUMP OPERATES AT
300 P.S.I. ON THIS STEEL MILL PILING EQUIPMENT

This power unit — used in conjunction with steel mill piling equipment — is a good example of Roper adaptability to heavy duty hydraulic applications. The unit is fabricated by the Weinman Pump and Supply Company of Pittsburgh, and the Roper used is a Series F.



DEPENDABILITY *Plus*

Roper Series F Pumps are used for pumping clean liquids of all kinds, and are self-lubricated by liquid being pumped. Four-port design (eight optional piping arrangements — 4 for C.W. and 4 for C.C.W. rotation) cuts installation time and costs. These pumps are supplied with or without relief valves — with packed box or mechanical seal. Pressures to 300 P.S.I. — 1-300 G.P.M. sizes.
Investigate how Ropers can fit into your hydraulic applications. Send for catalog.

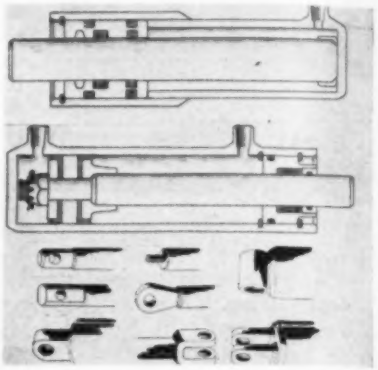
SEE OUR CATALOG IN SWEET'S

GEO. D. ROPER CORPORATION
703 BLACKHAWK PARK AVE.
ROCKFORD, ILLINOIS

ROPER *Rotary Pumps*

Circle 90 on Reader Service Card

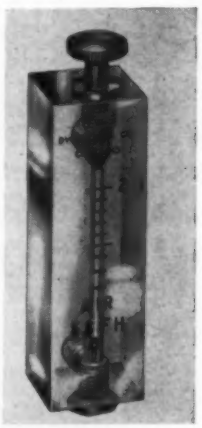
NEW CYLINDER DESIGN— Unit Manufacturing Company has introduced a new design in single and double acting hydraulic cylinders. All cylinders are available in any of



six clevis types as illustrated. Unusual or highly specialized cylinder designs, in addition, can be supplied to specification. Cylinders in the new Unit line are built around a single basic design emphasizing simplicity. Unit specializes in cylinders for machinery manufacturers on orders of 25 or more.

Unit Manufacturing Company
Circle 163 on Reader Service Card

FLOWMETERS— Eliminating inaccurate bubble counting and watch timing, a line of new type precision flowmeters has been introduced by F. W. Dwyer Mfg. Co. Of solid



acrylic construction, the flowmeter is precision drilled, reamed and polished to form a sturdy, accurate, easily read type of instrument. The standard unit includes a built-in control valve. Special scale ranges are available when ordered in productive quantities. Single units or one-piece multiple units for 0-2 cfh to 0-10 cfh at standard conditions are made for front-of board or flush panel mounting, with mounting holes furnished to specifications.

F. W. Dwyer Mfg. Co.
Circle 164 on Reader Service Card

Prevent Overheating

Concluded from page 60

Faster machine operation with cool oil and quicker cooling of the part in the chilled mold contribute to these figures.

Uniformity of operations of machine and mold through use of constant temperature water has eliminated many daily machine adjustments and much scrap which previously seemed to have no specific cause, and which was taken for granted as a necessary evil. Cooling water temperature had varied from hour to hour, especially as it does where towers are used, and production is actually tied to outside air temperatures.

So remarkable were the results of operation with uniformly chilled constant temperature, 45F water, that units are now available to cool the mold only, or both the machine and mold if necessary. These cooling units come complete in every respect except for local wiring and piping into the plant water system. Installations have to be individually engineered to take account of future expansion, water costs, etc., as well as estimated savings offset against cost of refrigeration equipment and power consumed by it.

Overheated oil results in:

1. Increased leakage
2. Reduced cycle time
3. Poor lubricating quality
4. Oxidation and breakdown of oil.

Since uniformity of plant water temperature at all times seems to be the chief source of added savings from closed systems, two types of circuits are offered. One is the open type, where the refrigerated circuit output is held constant by controls, and city or pond water is used to cool the compressor unit, the water so used being then passed to drain. The other is the completely closed type where savings in water used are also important. Here the circuit is completely closed, with a cooling tower being used to cool the compressor water. Again, output of the refrigerated water is held at a constant temperature by controls, and the compressor cooling water passing to and from the cooling tower takes care of the variations formerly carried to the injection circuit.

While pipes should be wrapped when using the refrigerated circuit, no other objection has been encountered. Naturally, the volume of water needed at 45F is much less than at elevated temperatures, so that oil coolers and mold passages which were seasonally inadequate are eliminated as a source of lost production when uniformly chilled water is used. In addition oil life is lengthened, leakage cut down, and other hydraulic troubles are reduced when oil is properly cooled at all times.

Good Packings demand PRECISION MOLDING

Like all other Rhoads Tannate Leather Products, this Vee Packing is "custom-engineered" to job applications — from raw hide to finished form. Rhoads cultivates and strengthens leathers' natural qualities through special tanning processes, thus giving Tannate leather extraordinary resistance to abrasion and wear, a low coefficient of friction, plus resistance to scoring or abrading. The Vee Packing is then molded and finished to micrometer dimensions. Infinite care exercised in the packing's manufacture assures a most effective double lip seal at both the inner and outer peripheries. Such a Vee leather packing can be used for low or high pressures, with rotary or reciprocating motions, as a piston seal or gland seal. . . . For complete data, write for Tannate Leather Packings Data Folder. J. E. Rhoads & Sons, 35 N. Sixth St., Philadelphia 6, Pa.

Tannate®

Cup Packings **U Packings**
Vee Packings **Flange Packings**
Hydraulic Discs and Washers

250 J. E. RHOADS & SONS
PHILADELPHIA • NEW YORK
CHICAGO • ATLANTA
YEARS PRODUCING FINE LEATHERS

Circle 89 on Reader Service Card

For liquid transfer where space is at a premium . . .

The New Series II **BRONZE**
OBERDORFER INTERNATIONAL
Close-Coupled **ROTARY GEAR PUMPS**

Bronze spur gears (Oberdorfer alloy #16438)
2 Mechanical pressure and suction seals
Carbon bearings (oilless)
Bronze housing (Oberdorfer alloy #16001)
2 Micro finished stainless steel shafts

These two motor driven pumps have all-bronze housing and gears, oilless carbon bearings, micro-finished stainless steel shafts (± 25/100,000 of an inch) and are powered by heavy-duty ⅓ h.p. motors* equipped with thermal overload protection.

They are intended to be used wherever a liquid has to be moved from one location to another in quantities up to 240 gallons per hour at pressures from 0 to 100 lbs. per square inch.

They are adaptable for a wide variety of industrial and chemical applications where a corrosion-resistant pump is required and space is limited. Their all-bronze body and gears permit use with most liquids.

* 110 volt AC, Motor standard but specially machined for pump mounting.

Capacity Tables Gallons per hour—1,725 R.P.M.—lbs. sq. in

Pressure	Pump No. 1½ CCC	Pump No. 2 CCC
0 lbs.	120 gal.	240 gal.
25 lbs.	110 gal.	220 gal.
50 lbs.	100 gal.	190 gal.
75 lbs.	95 gal.	170 gal.
100 lbs.	90 gal.	——

Dimensions and Prices (Pump only)

Pump No.	Height	Width	Length	Price
No. 1½CCC	2⅞"	2 11/16"	4¾"	$20.00
No. 2CCC	3 11/16"	2⅞"	4⅞"	22.50

All Prices F.O.B. Syracuse

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DEPT.-523 INDUSTRIAL PUMP DIVISION
Oberdorfer Foundries, Inc.
Syracuse, N. Y.

Circle 75 on Reader Service Card

Sawmill Drives

Concluded from page 65

carriage it may require several seconds for the carriage to reverse. Therefore, if the pump reversed its direction of flow immediately in response to the control lever, a great deal of oil would have to escape through a relief valve. This would produce considerable heat. Using a servo controlled pump makes it easy to regulate the rate of change of pump volume. An acceleration control was developed which regulates the flow of oil to the servo cylinder and therefore controls the rate at which the pump shifts. The control is actuated by pressure from the main pump lines.

When the operator throws his lever to the reverse position, the pump begins to shift stroke. This tends to slow down the carriage, the motor acting as a pump. The resulting pressure causes the acceleration control to slow down the rate of pump shifting. In this manner, a constant pressure is kept on the pump during the entire deceleration and acceleration period, with very little relief valve blowing. An interesting feature of this control is that during the deceleration, the power required is fed back through the drive to the electric line. This is the main reason for the high efficiency of this type of drive.

One very important consideration is the speed reduction ratio between the hydraulic motor and cable drum. For a given size drive there is an optimum top carriage speed for every carriage weight. It has been found mathematically that to obtain best performance, the top speed should be such that ¼ of the stroke is used for acceleration, ½ at full speed, and ¼ for deceleration. For best performance the ratio should be fairly close to the value giving this result.

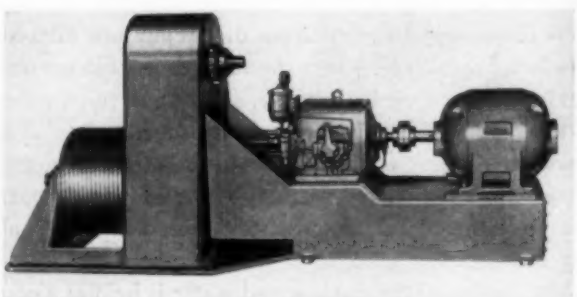

Fig. 3. A completely self-contained carriage drive is finding wide use in sawmills. The hydraulic servo lever on the side of the pump is manually controlled by the sawyer's control lever.

The selection of the proper size of drive for a mill is very difficult. A very small drive will move the carriage at the required speed and give sufficient force for sawing. However, to obtain the necessary high speed reversals, a great deal of what would seem to be excess power is required. The amount of power required depends on the weight of the carriage, the production required, the size and quality of log to be sawed, the type

of lumber produced and many other factors. Each mill must be individually studied to determine its needs. To aid in selection, curves have been prepared giving the number of lines or round trips per minute obtainable for various drives on carriages of varying weight. Figure 2 shows such a set of curves.

Installation of the drive is very important. While there are some advantages to tailoring each drive to the mill, it was felt that building a self-contained drive such as is shown in Figure 3 was preferable.

Service and maintenance provisions are most important because the hydraulic equipment used is quite unfamiliar to most sawmill personnel, particularly in the smaller mills. Because of the importance of the carriage drive, parts, spare units and trained servicemen must be available on short notice to the mill. In addition, service information on the drives must be made available to the mills.

The Mater Machine Works of Corvallis, Oregon, and George E. Zweifel Co. of Portland, Oregon did much of the pioneering on hydraulic powered carriage drive installations. The Mater Machine Works has done an outstanding job of designing and building self-contained carriage drives such as are shown in Figure 3.

The success of hydraulics on this particularly difficult application is due in large part, we believe, to the attention paid to the service and maintenance problems of the drives. The effort involved in putting the application on a sound footing more than paid for itself in preventing costly emergency service jobs and resultant customer dissatisfaction.

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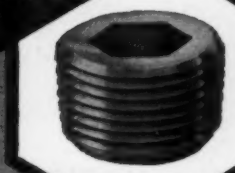

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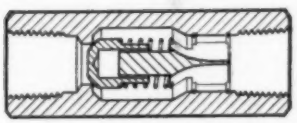

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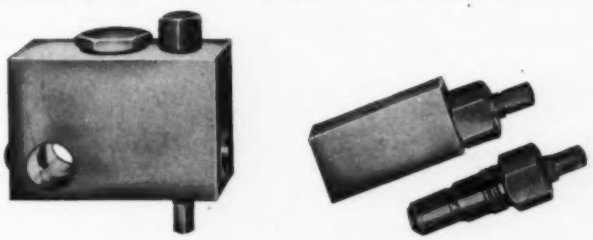

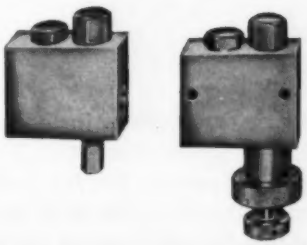

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RALPH E. MIDDLETON
Advisory Editor

How Much Air?

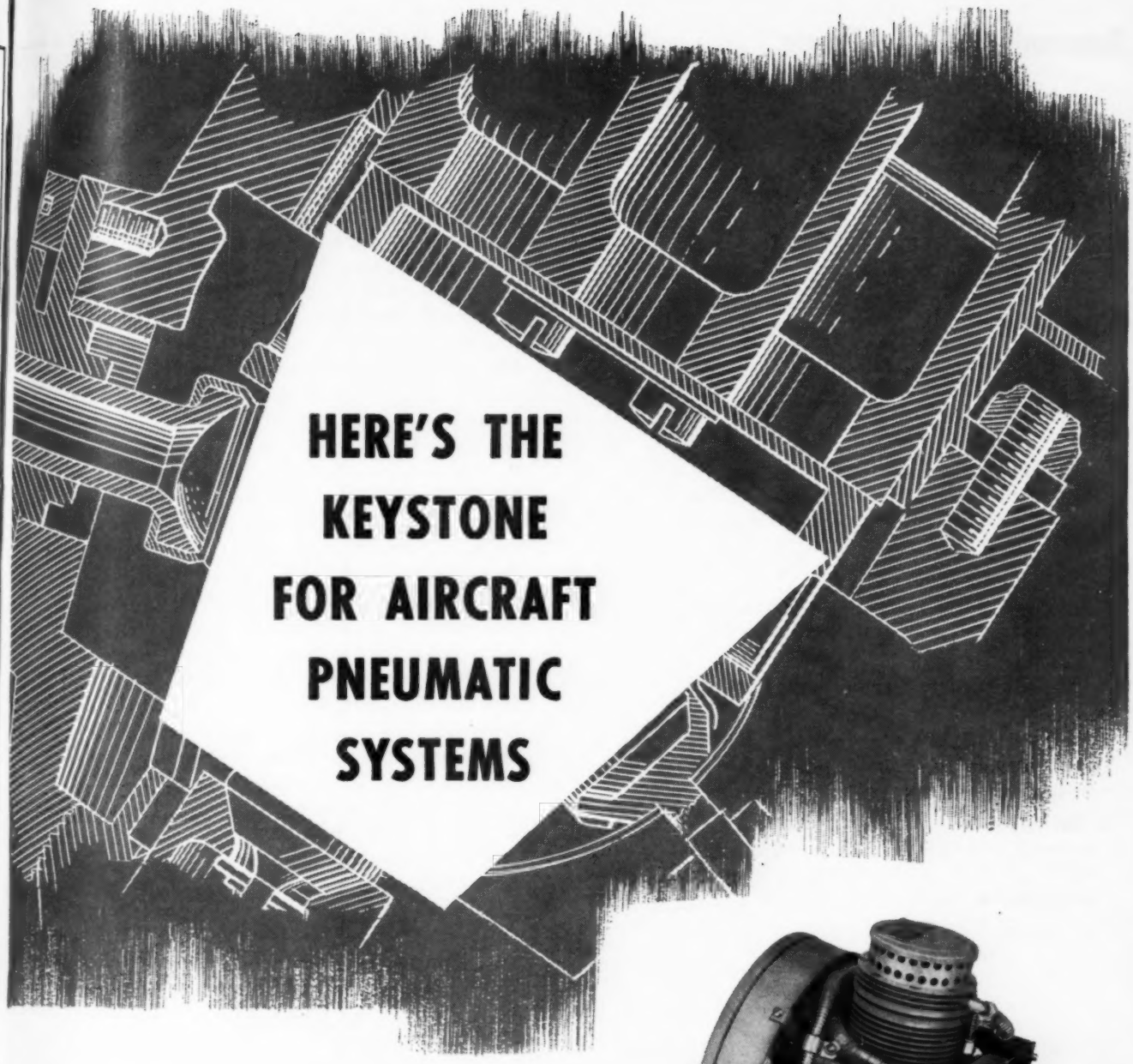
Presenting a graphical method of determining the capacity and requirements of a pneumatic storage system.

IT is generally recognized that gases, including air, do not follow the ideal gas laws exactly. The departure is not significant, however, for the range of conditions normally encountered in the usual applications of pneumatic systems. Therefore most pneumatic problems can be solved by the application of Boyle's and Charles' Laws and use of the equations for expansion or compression of air adiabatically, isothermally, or at some arbitrarily determined intermediate condition as required.

In aircraft applications the range of ambient temperatures encountered in normal military operations varies from +165F to —65F, and in some instances even greater variations have been encountered. Furthermore, the necessity for reducing weight leads to high working pressures and minimum storage volumes. These factors result in pneumatic operation in the range where the departure of air behavior from the perfect gas laws is quite marked, and their use may result in errors as high as 20 percent.

Calculations necessary to take the departure of air from perfect gas behavior into account are somewhat involved, which result in considerable time spent. This is undesirable, particularly when doing the preliminary

By Ralph E. Middleton
Lockheed Aircraft Corporation, Burbank, California



HERE'S THE KEYSTONE FOR AIRCRAFT PNEUMATIC SYSTEMS

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Remember These Terms?

- **Boyle's Law**
  at a constant temperature, volume of air varies inversely with the absolute temperature. (Perfect Gas Law)
- **Charles Law**
  at constant pressure, the volume of air is proportional to absolute temperature; at constant volume the pressure is proportional to absolute temperature. (Perfect Gas Law)
- **Absolute Temperature**
  temperature measured from absolute zero (—460F or —273C).
- **Adiabatic Process**
  there is no transfer of sensible heat to or from the air during adiabatic expansion or compression.
- **Isothermal Process**
  temperature of the air remains constant during an isothermal expansion or compression
- **Entropy**
  ratio of the heat added to the air to the absolute temperature; during a reversible adiabatic process entropy is constant; during a reversible isothermal process heat absorbed equals absolute temperature times change in entropy.
- **Enthalpy**
  an energy term which is the sum of the internal energy of the air and the energy of flow; also called the total heat.

investigating necessary in the early stages of design.

For this reason, it is desirable to have a chart from which the various factors can be obtained readily, even though in some cases the solution is only approximate, as long as the errors involved are small.

The accompanying chart is an endeavor to supply this need. This chart is basically a graph showing lines of constant entropy, constant enthalpy and constant density, plotted with temperature as ordinates and pressure as abscissae.

The use of these lines is based on the assumption that in most aircraft pneumatic functions the air is used rapidly. Therefore, for practical purposes, expansion of air in a container can be considered to be adiabatic, that is, heat flow into or out of the container during any single application can be neglected. The assumption is also made that no work is done by the air in expanding to a working pressure through a pressure reducer, and that the reducer therefore represents an orifice.

Examination of the chart shows three sets of lines superimposed on each other. One set, which crosses the chart diagonally, represents lines of constant density. Thus, if we have a closed container of air which was charged to a given pressure at a given temperature, the weight of air in the container, and thus the density, remains constant until air is either added or removed. The pressure will then vary with temperature along one of these lines. They are not straight lines, but their curvature and slope vary as the behavior of the air departs from the perfect gas laws.

A second set of lines having greater curvature than the density lines and crossing the chart diagonally at a relatively steep slope, is designated "Lines of Adiabatic Expansion". These lines represent the change in state of the air when it is rapidly compressed, or more important for our purposes, is rapidly expanded. This is what happens inside the storage container as air is rapidly withdrawn. Thus, if a container is charged with air at a pressure of 2000 psi at 80 F, our chart shows a density of 10 lbs. per cu. ft. If air is suddenly withdrawn so that the pressure in the container drops to 1000 psi, the temperature will now be -22 F and the density will be 6.55 lbs. per cu.ft. if we know the volume of the container, simple multiplication gives us the weight of air before and after the withdrawal, and thus we can find the weight of air withdrawn, in pounds. In this example, we followed down a line of adiabatic expansion to the new pressure, and then used the lines of constant density to determine the densities involved.

Now we have a third set of lines, crossing both the first and the second sets, at a much flatter slope. These we have called "Lines of Pressure Regulation". These lines represent what happens when air is passed through a pressure reducer, or regulator. If air followed the perfect gas laws, these lines would be perfectly horizontal, instead of having a slope.

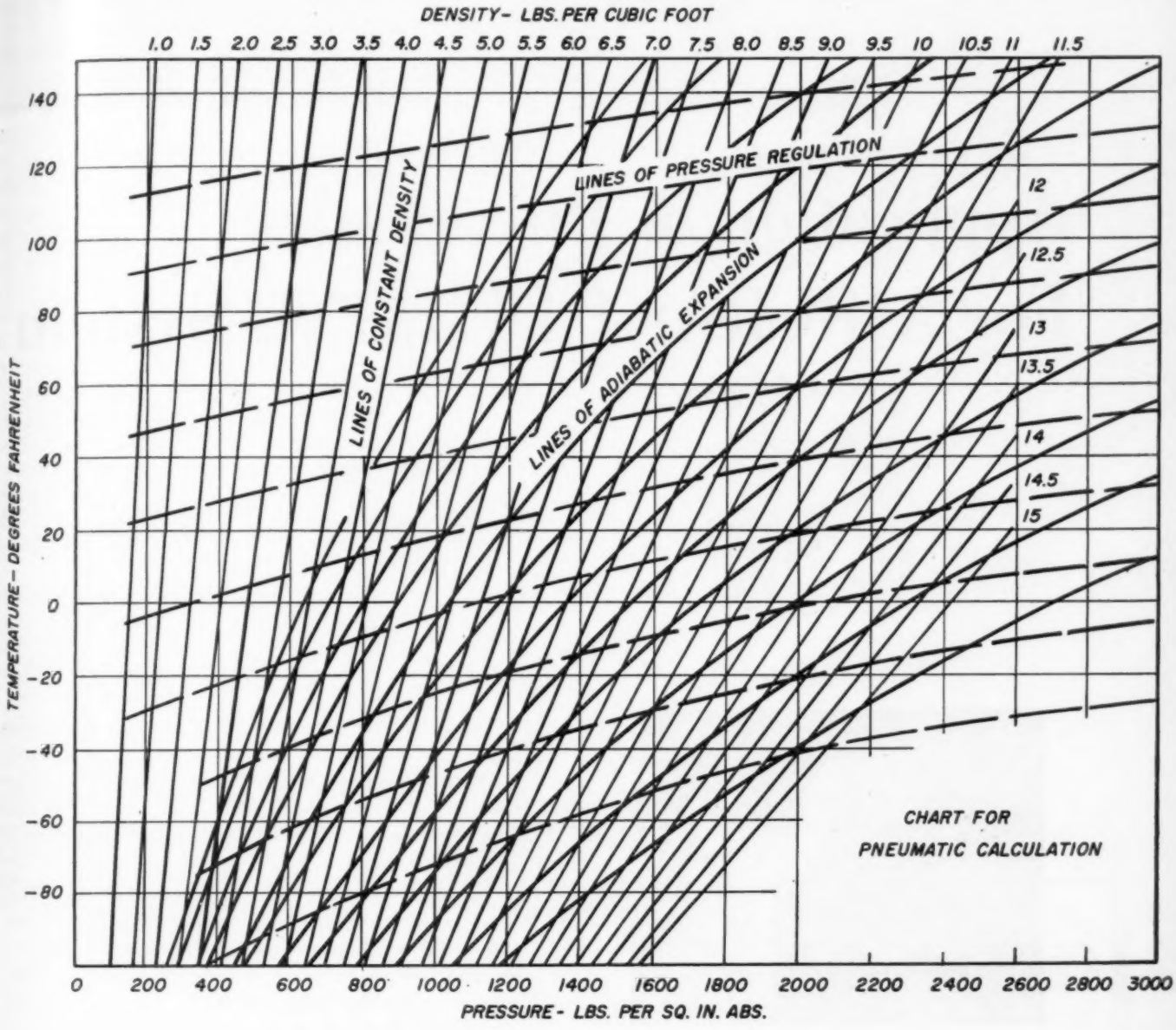
We now have superimposed on each other the curves which represent the behavior of air under the three most common conditions of operation in an aircraft pneumatic system—constant density, adiabatic expansion, and expansion through a pressure reducer. With these curves, we can solve a variety of problems.

How to Use the Chart To Solve Air Circuit Problems

Let us take a hypothetical system consisting of a storage container having a volume of 100 cu.in. This is to actuate a pneumatic cylinder having a displacement volume of 1.0 cu.in. The container is ground-charged to a pressure of 2000 psi absolute, and the temperature after everything has stabilized is 80 F. The air density is then 10 lbs. per cu.ft. and the weight of air in the container $\frac{100}{1728} \times 10 = 0.578$ lbs. Let us now take this system into an ambient temperature of —40 F. We therefore follow down a constant density line and find that the container pressure has dropped to 1420 psi absolute, although the density and the weight of air in the container remain constant.

We are going to operate our cylinder at a maximum working pressure of 1000 psi. We will then have in the system a pressure reducer, and to make this operate cor-

TEMPERATURE – DEGREES FAHRENHEIT


DENSITY- LBS. PER CUBIC FOOT
1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5 10 10.5 11 11.5
TEMPERATURE- DEGREES FAHRENHEIT
140 120 100 80 60 40 20 0 -20 -40 -60 -80
LINES OF CONSTANT DENSITY
LINES OF PRESSURE REGULATION
LINES OF ADIABATIC EXPANSION
12
12.5
13
13.5
14
14.5
15
CHART FOR
PNEUMATIC CALCULATION
0 200 400 600 800 1000 1200 1400 1600 1800 2000 2200 2400 2600 2800 3000
PRESSURE - LBS. PER SQ. IN. ABS.

rectly we will need a minimum pressure in the container of 1200 psi. Therefore, the air in the container can be expanded adiabatically by flowing air out through the reducer until the pressure has dropped to that value. The density in the container can be determined by starting with our point of 1420 psi at a density of 10 lbs. per cu.ft. and following down a Line of Adiabatic Expansion to the new pressure of 1200 psi. This gives us a density of 9.1 lbs. per cu.ft. The weight of air that can be removed from the container to do useful work is then

$$(10 - 9.1)\ \frac{100}{1728} = 0.052 \text{ lbs.}$$

The air flowing from the container into the cylinder expands through the reducer and causes the piston rod to move through its full stroke, until it finally comes to rest and the pressure stabilizes at the regular setting. We can determine the density of the air in the cylinder at that time by taking the point on the density line corresponding to the temperature and pressure existing in the container and then following down a Line of Pressure Regulation to the regulated pressure. In our example, we find the new density to be 7.25 lbs. per cu.ft. The weight of air used in one stroke of the cylinder is thus

$$\frac{1.0}{1728} \times 7.25 = .0042 \text{ lbs.}$$

Since this quantity represents a relatively small proportion of the total quantity available in the container, it can be assumed that the density of the air flowing into the cylinder will not vary appreciably during one stroke.

Application of Pneumatics For AIRCRAFT DE-ICING System

Fig. 1. The De-Icer boot and fairing strip on the leading edge of an AD Skyraider wing. A cycling test is being checked by stop-watch.

THE AD Douglas Skyraiders, high speed night attack planes, operating with the fleet in Korea, were forced to fly low because of the danger of ice forming at higher altitudes. They needed de-icers — and fast!

The Navy and Douglas brought the problem to The B. F. Goodrich Company and to Eclipse-Pioneer Division of Bendix Aviation Corporation. Goodrich tackled the problem of the rubber "boot" sections on the leading edges of wings and tail surfaces. Eclipse-Pioneer set to work on the problem of providing a system that would break up accumulated ice formations. It was a tough problem because de-icers had never been used before on this type of high speed airplane. Would de-icers stay on at high speeds? Would they disturb the flight characteristics of the plane?

A successful answer, the joint development of BuAer, Douglas El Segundo, Goodrich and Eclipse-Pioneer, was found. Only 32 days elapsed before a new improved de-icer system, incorporating multiple small tubes actuated by twice the conventional air pressure, was designed, installed and flight-tested.

The entire inner surface of the De-Icer (Trade name registered by The B. F. Goodrich Co.) was cemented to the wings, supplemented by the usual screwed-on fairing strip. Tested in a high speed dive, the new De-Icer came through without a sign of damage. Original flight characteristics were maintained.

Eclipse-Pioneer worked out a solenoid operated manifold De-Icer system using an engine driven air pump, cycle controlled by an electronic timer, a pressure regulating valve, distributor valves and pressure and suction manifolds.

The air pump, see diagram, Figure 3, delivers air at 15-18 psig through a safety valve to the primary oil separator where approximately 75 percent of the oil in the air is removed and returned to the engine oil sump. The air then passes through a combination oil separator, regulating and unloading valve. This unit removes all the oil and oil vapor left in the air before it goes into the main pressure manifold.

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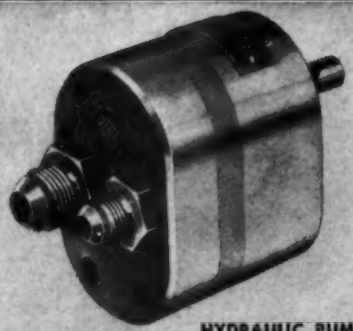

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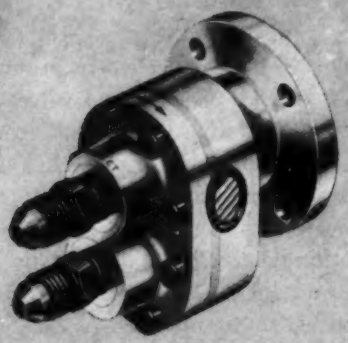

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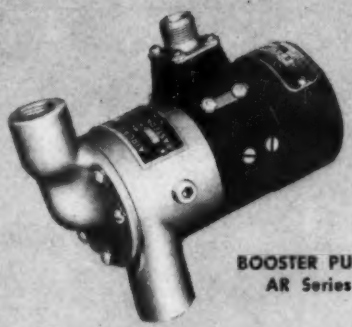

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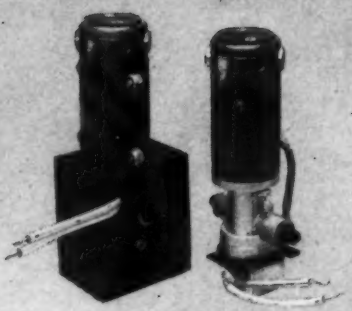

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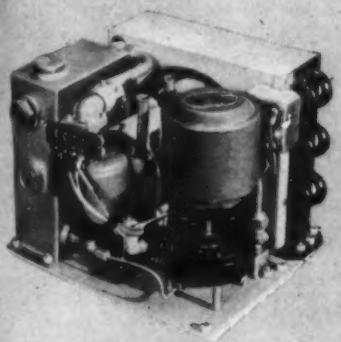

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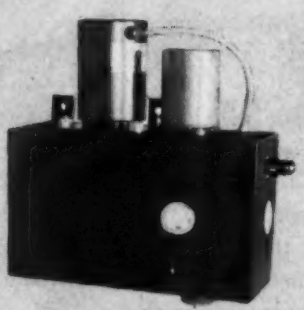

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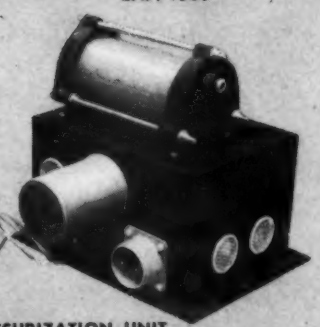

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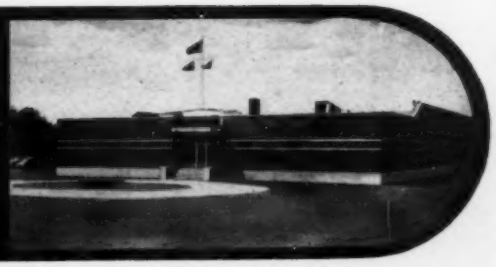

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The solenoid operated control valve in this unit causes air to be discharged overboard when the system is not in operation. When the system is operating, the control valve admits air to the oil separator element, a cartridge cellulose cotton filter element in turn, then to the pressure manifold. The control valve also functions as a pressure regulating valve when the system is in operation by discharging excess air overboard before it passes through the separator section.

The suction side of the air pump is connected through a suction relief valve to the suction manifold. The pressure and suction ports of each distributor valve are connected to the pressure and suction manifolds.

Air Alternately Inflates and Deflates Rubber Boots

Ports "A" and "B" of the valve are connected to ports "A" and "B" of the De-Icer boots; the discharge port is piped overboard. The solenoid actuated distributor valves alternately connect ports "A" and "B" to the pressure and suction manifolds, inflating and deflating the boot sections in a sequence determined by the electronic timer. The discharge port of the valve allows the air pressure to be discharged overboard from the boot section after each inflation cycle.

When the system is not in use, suction is applied to ports "A" and "B", so that boots are held tightly against the surface to prevent auto-inflation.

The distributor valves are electrically connected to the electronic timer control, functionally a series of simple switch circuits actuated successively by a solenoid operated rotating stepping switch. The operation of this switch is controlled by the electronic timing circuit. Each switch circuit controls the operation of one section of the De-Icer boots by actuating the solenoids in the De-Icer distributor valves. Automatic cycling of the De-Icer boots is obtained by a control switch in the cockpit.

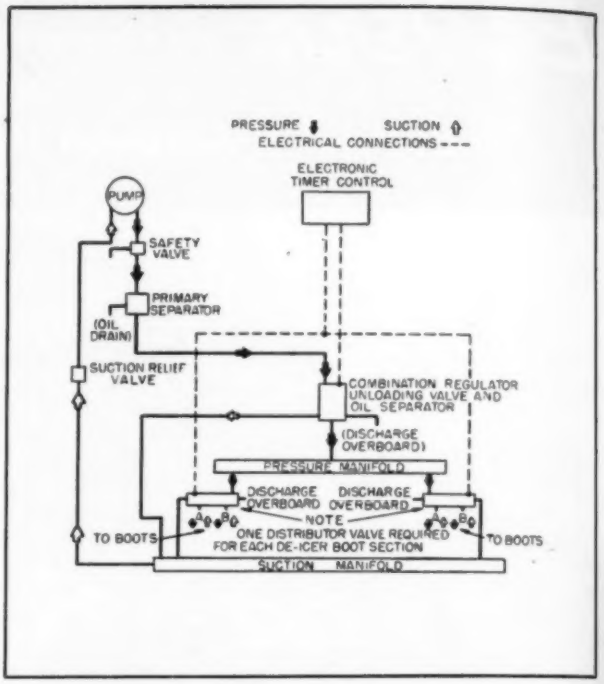

Fig. 3. A schematic diagram of the De-Icer system installed on the AD Skyraider.

The De-Icer system is compact; the system with four solenoid valves weigh less than 38 pounds. The "emergency" De-Icing system has worked out very satisfactorily under combat conditions. The AD Douglas Skyraiders in the Korea area now go wherever and whenever their missions dictate.

Photos courtesy The B. F. Goodrich Company
Diagram courtesy Eclipse-Pioneer Division of Bendix Aviation Corporation

Fig. 2. The Douglas Skyraider on its way to make a "delivery".

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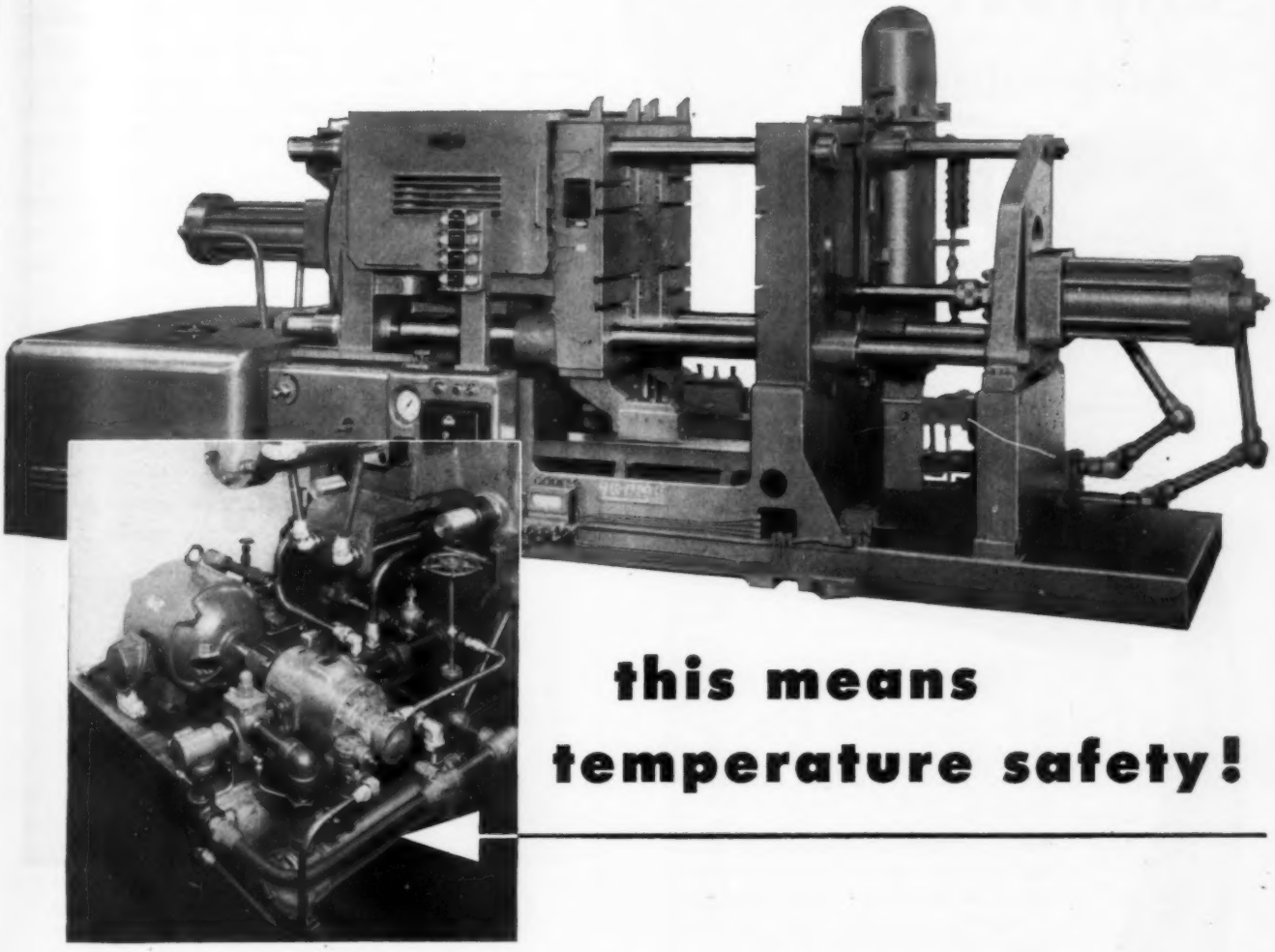

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Lift Material to Work Level With Oil Power

A Florida tile contractor cut time and labor costs by utilizing a standard hydraulically operated lift unit to unload tile directly on the roof. The savings, at no extra cost to the general contractor, has given the Patent Tile Company of Opa-Locka a big jump on their competitors.

THE Patent Tile Company of Opa-Locka, just north of Miami, Florida, got complaints from their contractor customers because their supplies, especially roofing tile, were unloaded in the wrong places. This was a serious situation in the area where more than nine buildings out of ten have tile roofs. Patent Tile Company solved this problem by the acquisition and use of a hydraulic lift unit mounted on one of their regular delivery trucks. "On the job" really means that,

Unloading tile at Opa-Locka, Florida, at roof level from the elevated position of a Hi-Lift equipped truck. The cost saving has been a major advantage to the contractor and an economy to the ultimate purchaser.

since the truck backs up to a construction job, raises the load to the level of the roof for unloading.

This service, provided at no extra cost to the contractor, eliminates the hard and slow job of manually carrying tile up ladders or the costly installation of an elevator. The time alone saved is an advantage which contractors have accepted eagerly. In addition, the oversaving is reflected in costs to the ultimate purchaser.

Simple Power System

The hydraulic work circuit consists of a double drive shaft gear type pump which delivers 13½ gpm at 800 psi and 1000 rpm, a hydraulically balanced, three position spool valve and two double acting cylinders. In the raise position, all ports are closed and the high pressure oil passes directly to the hoist cylinders; in the lowering position, all ports except the delivery port are open, the pressure opening a ball check to the pump

manifold where this by-pass flow joins the oil returning from the hoist cylinders; in the hold position, the delivery and return ports are open and the cylinder return port is closed, forcing the ball check closed. A spring loaded lock holds the valve spool securely in the holding position.

The standard lift has a capacity for elevating 8000 pounds to a height of 12 feet 6 inches. The unit, which may also be operated to dump to the rear as a conventional dump body, was orginally built to the specifications of the U.S.A.F. as a quick loader and unloader for cargo planes.

Basic Pneumatics Course

Concluded from page 83

cuit or system so that the designer will readily recognize every practical possibility for using pneumatics as a power source or working tool.

Pneumatics is one of our oldest sources of power for performing useful work. With the modern development of pneumatic units—compressors and their necessary units, high efficient work and control components, compressed air is coming more and more into its own as a basic power source. Designers, with the fundamental advantages of pneumatics firmly in mind, may select compressed air as the first choice, as an alternate choice, or as a practical possibility for a wider and wider range of applications.

Next month we will begin a discussion of the atmosphere. The April installment "Atmosphere and How We Use It" introduces the first of a number of basic rules or principles on the physical properties of atmospheric air.

Electrical Interlocks

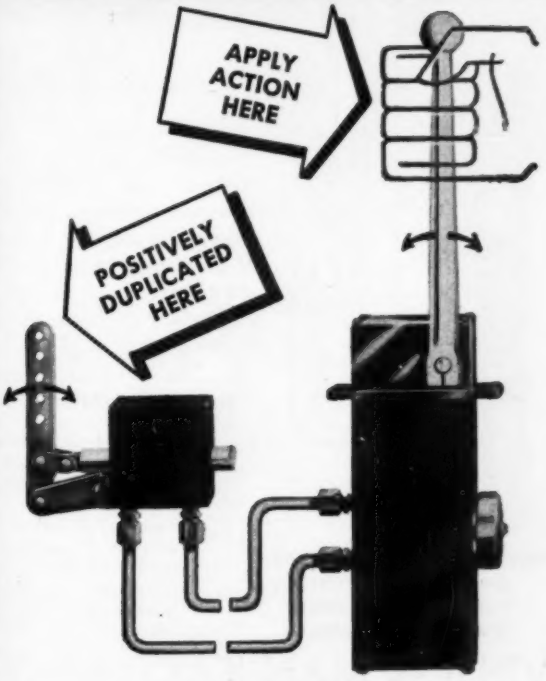
Concluded from page 58

TR, which eliminates any chance of the wiping arm releasing its pressure while rotation continues at the end of the stroke. The timer also holds the part for the final end set. The operator removes the part from the fixture and then presses mushroom push buttons to energize solenoid 4 and return the wiping tools to the loading position where LS-2 is actuated to de-energize solenoid 4 for return rotation.

Continued on next page

SUPERDRAULIC

PUMPS • VALVES • TRANSMISSIONS • TEST STANDS • REMOTE CONTROLS



POSITIVE REMOTE CONTROL

A simplified device for positioning, controlling and duplicating movement at a distance. Automatically compensates for contraction and expansion of fluid media. Operates with a smooth, rigid, silent and sensitive stroke. Many superior engineering features.

APPLICATIONS INCLUDE: processing machinery, assembly fixtures, air and marine craft, earth moving, farm, railroad and construction equipment, machine tools, test cells and military vehicles. Write for catalog.

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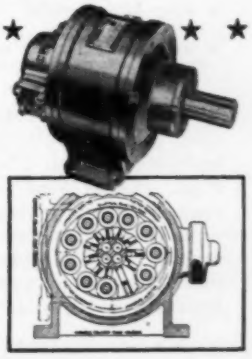

FAMOUS SUPERDRAULIC HIGH PRESSURE PUMP

Develops up to 60 H.P. at 5,000 P.S.I. Let us quote on your requirements.

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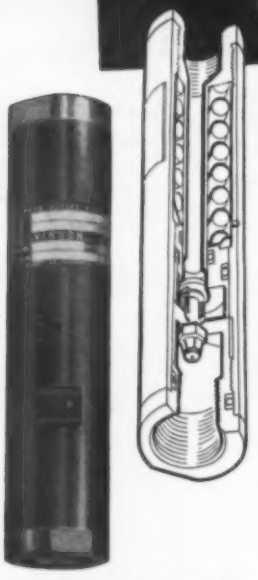
NEW! balanced outlet RELIEF VALVE



For pressures to 3000 psi

The new exclusive Vinson design is completely balanced and indifferent to pressure changes or surges down stream. Its operation is silent and smooth with no chatter, no squeal, no screech. Manufactured in four sizes 1/4", 3/8", 1/2" and 3/4", the valve is offered in three configurations.

1. Standard unit with reverse flow checked.
2. Free flow in reverse direction.
3. Twin relief valve which relieves in both directions. Included in its applications are relief, sequence and surge damping.

May we assist you with your valve requirements. Write or wire today for prompt service.

VINSON MANUFACTURING CO.
8044 WOODLEY AVE. • VAN NUYS, CALIF.

NEW HIGH PRESSURE SOLENOID VALVES

Now available in 110 —220 volts 60 cycle A. C. current

Features

- Rugged compact construction
- 3000 P.S.I. operating pressure
- Continuous duty
- Poppet design eliminates leakage
- May be mounted in any position
- Impregnated coils resist moisture and condensation

Waterman High Pressure Solenoid Valves are inexpensive, compact units designed for continuous duty in hydraulic systems where pressures are as high as 3000 P.S.I. Poppet type construction gives positive sealing against internal leakage. Impregnated oil resistant coils make these valves suitable for mounting in oil reservoirs. In many cases this feature eliminates costly piping and makes possible the construction of smaller, more compact hydraulic power units. Available in 3/8" and 3/4" pipe size.

West Coast: H. E. Webb, 918 No. Kenilworth Ave., Glendale, Calif.

WATERMAN ENGINEERING Company
725 CUSTER AVENUE • EVANSTON, ILLINOIS

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Electrical interlocking has not only given us a machine which is safe, it provides a flexible circuit which can be readily altered to adjust the cycle of operation.

Here's what happens to the electrical contactors and oil valves as the hydraulic cylinders power the machine.

Having loaded the work, the operator steps on the foot switch to energize control relay CR-1, actuating solenoid 1 to clamp the work. Only after clamping is tight and oil pressure has built up, does a sequence valve open and allow pressure oil to move the wiping tools into position. N.O. contacts CR-1 close to hold the circuit when the foot switch is released. N.C. contacts CR-1 open to prevent accidental energizing of CR-4.

Pressure on the ironing cylinder builds up to close the pressure switch, PS, energizing CR-3 to actuate solenoid 3 moving the rotating cylinder which sweeps the ironing cylinder through the forming arc by action of rack and gear. N.C. contacts CR-3 open to prevent unclamping during forming. At the end of the forming stroke, double throw limit switch LS-1 is tripped to de-energize the clamp solenoid and energize timing relay,

Aluminum Extrusion

Concluded from page 56

The Guide Company also selected hydraulic and air power for the many auxiliary functions required on an aluminum extrusion press. Control valves and several of the seven cylinders used for press operations are seen in Figures 1 and 2.

Here is what happens to an aluminum billet:

Heated to 600 to 900 degrees in a furnace seen directly in front of the press, Figure 1, the billet is conveyor fed into the loader. The loader is a pneumatically actuated linkage which moves the billet from the furnace into the press and slides the billet into the heated billet container. In Figure 1, a billet is seen coming from the furnace into the loader. With the billet in the press container, the stem, which had been lifted out of the way to permit loading, is lowered.

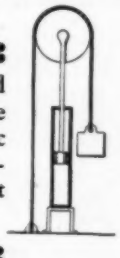
The ram now moves forward to extrude the billet through the dies. After extrusion the ram reverses only one inch to remove pressure from the billet and dies. The die locks then pull out. The ram moves forward to push the butt out of the container and then reverses to start position. A die shift cylinder pulls the die to the shear where the butt is cut off. The stem is then lifted; the die pushed back; die locks move in; and the container is pulled against the die ready for another billet. The complete cycle can be completed in approximately one minute.

Applied Hydraulics thanks C. R. Gibbons, President of The Guide Company; Frank M. Magyar of S. G. Morris; and G. R. Pittman of The Hydraulic Press Manufacturing Company for their cooperation in the preparation of this article.

got a TENSION LINKAGE problem?

If you design hoists, lift trucks, counterweight suspensions, controls or any type of equipment where you must transmit pull or lift something, Baldwin-Rex® Roller Chain, Leaf Chain or Block Chain is likely to be the answer to your linkage problem.

here's a good example:



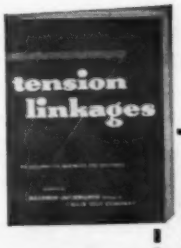
Increase of travel distance on a hydraulic lift. The chain, fixed at one end, passes over the sprocket, and is attached to the lift platform. The sprocket shaft is carried on the hydraulic plunger rod. In the arrangement illustrated, vertical movement of the platform is twice that of the plunger. Movement is frequent and shock loads are severe, so *chain* is the answer. If the lift is mounted on a truck, severe shock and fatigue stresses are imposed on the chain as the truck moves.

here's another one:

Transmission from a double-acting hydraulic cylinder to a shaft. Since motion must be transmitted in two directions, an idler sprocket is required as shown in the illustration. Since operation may be practically continuous, and shock effects are probable, *chain* is the answer. When this type of installation is applied to rudder control, shock and fatigue considerations are especially important.

our Tension Linkage bulletin

Covers typical examples of tension linkage applications . . . helpful step-by-step data on equipment selection and examples to guide you in making your selections. There are tables of dimensional data and other important facts you'll find useful in your work. Send for your free copy today. Just fill in and mail the coupon below. There is no obligation.



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HYDRECO solves another tough control problem

HYDRECO VW SERIES
HYDRAULIC STEERING VALVE

The Terra-Cobra, built by Wooldridge Manufacturing Company, Sunnyvale, California, hauls a lot of dirt and travels fast. The HYDRECO designed and built model VW2X1 steering control valve provides the effortless hydraulic steering and perfect control that this big machine requires for most efficient operation.

Slack in the steering chains and possible momentary loss of control cannot develop, as flow controls built into the valve keep positive tension on the steering chains under all conditions.

As the flow controls are built right into the same valve housing with the steering controls, external piping is reduced to a bare minimum.

Let HYDRECO engineers show you how fast and safe control of earth moving equipment and other mobile units means savings for users and profits for you. Please write us.

HYDRECO OIL HYDRAULIC CONTROLS

HYDRAULIC EQUIPMENT COMPANY
1104 EAST 222nd STREET • CLEVELAND 17, OHIO

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Continued from page 78

Tubing Failures . . . The many factors affecting tube life in high-pressure, high-temperature applications are presented in a new 40-page illustrated booklet published by the Tubular Products Division of The Babcock & Wilcox Company. The booklet, TR 516, presents the results of a great number of investigations of failures of carbon steel, intermediate chromium-molybdenum alloy steel and stainless steel tubing in boilers, cracking stills, heaters and heat exchangers during service at elevated temperatures and pressures in the power, oil and chemical processing fields. It displays the history and experience behind the contemporary development of high-temperature tubing and will be of assistance to those in the field to obtain optimum failure-free service from their tubing installations.

Circle 211 on Reader Service Card

Plate Filters . . . Twelve advantages of horizontal plate filtration are discussed in a folder prepared by Sparkler Manufacturing Co. Construction is detailed and various applications are discussed. Specifications which include capacity, filtering area and physical dimensions are charted.

Circle 212 on Reader Service Card

Flexible Metallic Packings . . . An 8-page bulletin illustrating and describing the complete line of R/M Flexible Metallic Packings has been issued by the Packing Division of Raybestos-Manhattan, Inc. Included in the bulletin are descriptions, service recommendations and illustrations of "V" metal insert packings, metallic valve stem, plastic core metallic face, all metallic, flexible metallic, high temperature aluminum, and braided copper packings. Each type is available in several forms and the bulletin also provides information on standard sizes, standard packages, and approximate weights.

Circle 213 on Reader Service Card

Controlled Volume Pumps . . . Bulletin 251 on Milton Roy motor driven controlled volume pumps has been published by Milton Roy Company. This 24-page illustrated bulletin will be of interest to anyone faced with the need of pumping practically any liquid, from heavy viscous liquids to light solvents. Both standard and special models are described. Also included are details on how pump capacity can be regulated by plunger speed and plunger stroke adjustments. Capacity and pressure selection tables form a part of this bulletin to help users select the right pump for their particular application.

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The "manufacturer's" gauge—

For years Marsh Gauges have been first choice of manufacturers of controls and other equipment where pressure indication plays a vital part. Their use on *your* product is a mark of distinction.

The finer construction of Marsh Gauges is not limited to costly types, but is common to the entire line in square relationship to the service for which they are recommended. All—regardless of cost—are *quality* instruments.

Write for this catalog covering the broader Marsh line.

MARSH INSTRUMENT CO.
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Export Dept., 155 East 44th Street, New York, New York

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The only COMPLETE Line

Patented and patents pending

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QUICK COUPLERS

For All Hydraulic Lines!

Just a "Twist-of-the-wrist" to connect under pressure.

A model and size for any problem! Standard and Break-A-Way types . . . connect under pressure without tools.

WRITE FOR FULL DETAILS

ULRICH MFG. CO.
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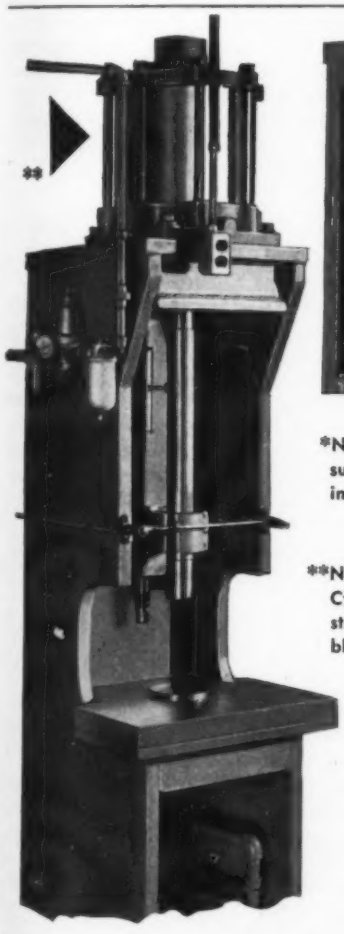

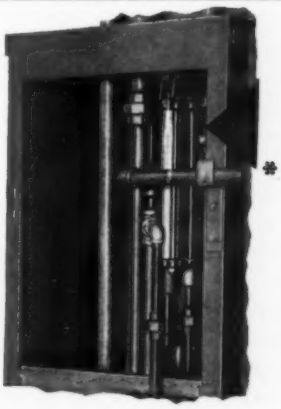

*NOPAK Model "E" Cylinder supplies clamping or holding power for work-piece.

**NOPAK Model "D" 12"x8" Cylinder provides power stroke for "squeeze assembly" operation.

PRESS MOVEMENTS
Powered by
NOPAK CYLINDERS

Throughout industry, a variety of vital press movements are powered by NOPAK Cylinders, both air and hydraulic. For example, you'll find them on arbor presses, kick presses, punch presses, drill presses, baling presses, assembling presses, forming presses, power shears, power brakes, clamping devices, and similar equipment. NOPAK Valves control the cylinder movement.

If you build presses, there is probably a NOPAK Cylinder that's *just right* for your needs. Perhaps there are mechanically or manually operated presses in your plant which could be powered by air or hydraulic NOPAK Cylinders, and controlled by NOPAK Valves, to save valuable time, eliminate needless manual effort, speed up production.

GALLAND-HENNING MFG. CO.
2743 SOUTH 31ST STREET • MILWAUKEE 46, WISCONSIN

Representatives in Principal Cities

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Refer to Sweet's File for Product Designers or write for Bulletin SW-1

NOPAK
VALVES AND CYLINDERS
DESIGNED for AIR and HYDRAULIC SERVICE

A 7019-½-H

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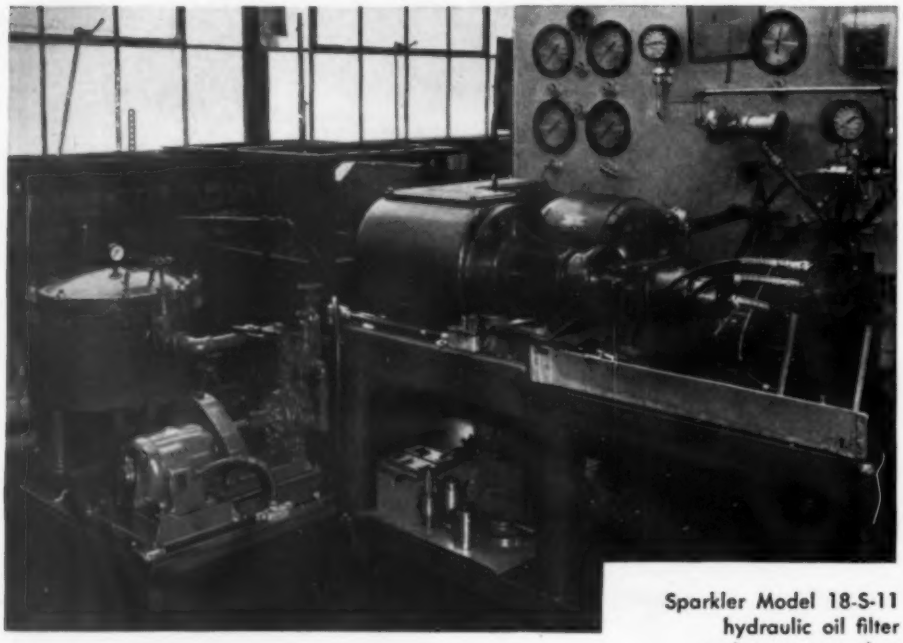
"...like SPARKLER hydraulic oil FILTERS best

for economical operation and long cycles"



Sparkler Model 18-S-11 hydraulic oil filter used on test stand at Blackhawk Mfg. Co., Milwaukee, Wis.

The Sparkler hydraulic oil filter shown in the accompanying photo is permanently installed on a hydraulic test stand where pumps and valves coming off the production lines are subjected to rigid inspection tests. The filter, a Sparkler Model 18-S-11, operates continuously during test cycles, and serves to remove metal particles, lint, and other impurities that are flushed from the pumps and valves by the hydraulic oil used here. Performance of the unit has been superior in every respect, particularly because of long cycle length and minimum operating expense.

Used as a permanently installed unit, or as portable equipment, a Sparkler filter needs little floor area because of its compact design. It can be cleaned easily in just a few minutes and a complete refill for the average Sparkler filter costs less than a dollar. Most important, a Sparkler filter gives you selective filtration — you pick the degree of filtration best suited to each application, then let the Sparkler filters do the job. All gums, varnishes, sludge, rust and grit are positively removed by mechanical, surface type filtration so that leakage and drainage oils can be reclaimed.

For more complete information or engineering assistance, write Mr. Eric Anderson

SPARKLER MANUFACTURING COMPANY, Mundelein, Illinois

Sparkler International, Ltd.
Herengracht 568, Amsterdam, Holland

Sparkler Western Hemisphere Corp.
Mundelein, Ill., U.S.A.

Manufacturers of fine filtration equipment for more than a quarter of a century

NEW Sparkler Model VR

This new filter employs an adaptation of the Sparkler horizontal plate to provide exceptionally large area in standard size tank. It is a low-cost unit that is particularly well-suited to hydraulic oil filtration and to any large volume operation.

Ask for new Model VR bulletin.

Circle 99 on Reader Service Card

Tube Fittings . . . Swagelok Tube fittings Catalog B-151 describes and illustrates the complete line of leakproof Swagelok tube fittings which are available in brass, aluminum, steel, stainless steel and monel. Complete dimensional information, cross-section drawings, installation recommendations and assembly instructions are included in this catalog which has been prepared by Crawford Fitting Company.

Circle 215 on Reader Service Card

Mercury Switches . . . The five most popular designs of Honeywell mercury switches, with selection and applications aids, and complete electrical ratings and data for the use of these switches in both a.c. and d.c. applications are covered in a new catalog. Prepared by Micro Switch, a division by Minneapolis-Honeywell Regulator Company, Catalog No. Hg-1 illustrates the solution to several application problems.

Circle 216 on Reader Service Card

Silver Brazing . . . The Research Division of the American Platinum Works offers a complete library on low temperature silver brazing in a 48 page booklet-size manual. All generally useful information has been included in this work. More than 50 drawings and charts are used to illustrate the text. The booklet provides correct answers to general questions on low temperature brazing, brazing alloys, joint design, preformed brazing shapes, plymetals, fluxing, heating methods, cleaning and inspection.

Circle 217 on Reader Service Card

Machining Copper Alloys . . . A 32-page booklet suggesting cutting speeds, feeds, tool rakes and clearances to be used on more than 40 different copper alloys is offered by The American Brass Company. This guide is based on the use of standard cutting tool materials and contains many helpful and practical suggestions on turning and cutting-off tools; form tools; drills, reamers and taps; thread chasers, milling cutters and coolants.

Circle 218 on Reader Service Card

Swivel Joints . . . Versatile piping layout is made possible by the use of swivel joints. The Chiksan Company has printed an 8-page bulletin describing their ball bearing swivel joints. Available in sizes ranging from ⅜ to 5 in., these joints will handle fluids at pressures up to 3000 psi.

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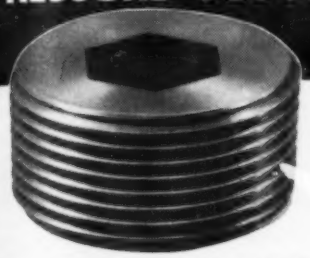
UNBRAKO

DRY-SEAL THREAD PRESSURE PLUGS



SEAL TIGHT without compound

... provide positive sealing even under extreme pressures

UNBRAKO *Dry-Seal* Pressure Plugs—in a full range of sizes from 1/16" to 1¼" National Pipe Thread "Fuel"—are available from your local UNBRAKO distributors' stock. For descriptive literature, write STANDARD PRESSED STEEL CO., Jenkintown 2, Pennsylvania.

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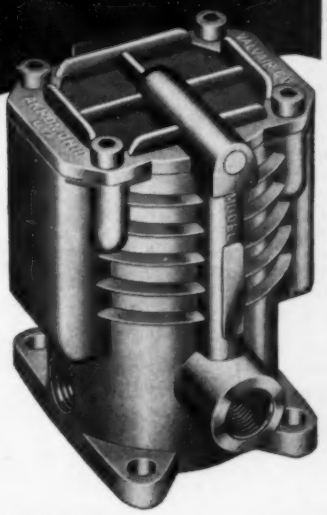
DESIGNERS' DREAM COME TRUE!

The *New* VALVAIR SOLENOID PILOT VALVE



Outstanding Features in a New Valve PRICED ATTRACTIVELY!

- OVER 20,000,000 CYCLES
- CORROSION-PROOF
- NO OVERHEATING
- MANIFOLD MOUNTING AVAILABLE

SIZE: ¼" pipe tap, orifice ⅛" or 3/16".

Write for new Bulletin A-3.

The NEW Valvair Solenoid Pilot Valve is offered in 2-way and 3-way models, normally open or normally closed. Coils are completely sealed. Only two moving parts: spring and plunger. Valve life is almost unlimited.

VALVAIR CORPORATION • 951 Beardsley Ave., Akron 11, Ohio

Affiliate: Sinclair-Collins Valve Company

Rely Upon Valvair — 2-WAY — 3-WAY — 4-WAY

See this unit in operation at the 5th NATIONAL PLASTICS EXPOSITION MARCH 11-14 Honan-Crane Booth No. 451-453

See for yourself

NEW Houdaille Water-Oil Separator

removes water from oil in all types of HYDRAULIC equipment

automatically... continuously!

- Practical new unit reduces water content of oil to an insignificant trace. Maintains clean, dry hydraulic oil in safe operating condition indefinitely.
- Separator actually filters the oil—as it separates the water. Removes solid contamination, acids and other sludge-forming products of oxidation—eliminates need for changing or discarding oil regardless of type of contamination.
- Unit is easy to install, fully automatic in operation. Eliminates downtime and repairs—quickly pays for itself in oil savings alone.

Equipment bulletin with complete details available on request. Write to:

Honan-Crane Corporation
102 Wabash Avenue, Lebanon, Indiana
a subsidiary of
Houdaille-Hershey Corp.

WORLD'S LEADING OIL FILTER MANUFACTURER

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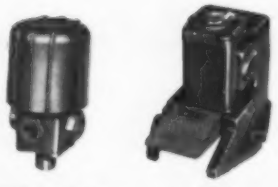
FOR RESISTANCE TYPE WELDERS • FOR AIR VISES • FOR MACHINE FEEDS • FOR PRESS BRAKES • FOR STEEL MILL EQUIPMENT • FOR AIR CLAMPS • FOR AUTOMATION • FOR LATHE CHUCKS •

You'll find Air Valves for every job in this

COMPLETE

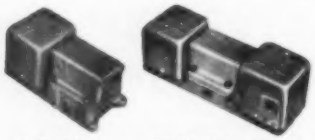
MAC

Air Valve Line

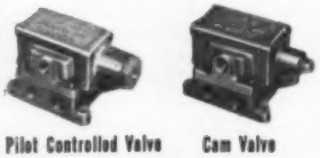


Solenoid In-Line Valve — Foot Valve

Solenoid Pilot Valve — Hand Valve



Solenoid Valve — Double Solenoid Valve



Pilot Controlled Valve — Cam Valve

For Trigger-Quick Control of All Air-Operated Equipment

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Straightway, 3 way, 4 way

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Sizes: ¼" thru ¾"

EFFICIENT! Full flow design . . . plus simplified construction with only one moving part . . . add up to more dependable performance, longer life, reduced maintenance.

COMPACT! The compact design of MAC valves makes them especially adaptable for installations where space is limited.

ECONOMICAL! Yes . . . with all their extra advantages, MAC valves are actually priced *lower* than many ordinary air valves. Here's an investment that really pays off!

MAC MECHANICAL AIR CONTROLS

BOX 5171 SOUTHFIELD STATION, DETROIT 35, MICH.

Write For Free Catalog No. 52-A.

Circle 66 on Reader Service Card

ASLE National Meeting to Include Hydraulic Forum

W. F. Leonard, national secretary, American Society of Lubrication Engineers, announces that the 1952 annual meeting will be held at the Statler Hotel, Cleveland, April 7, 8 and 9. A total of thirty-three papers on technical and semi-technical phases of scientific lubrication and their practical applications are on the program. The largest attendance in the society's history is expected.

Hydraulic Forum

One of the outstanding features will be a Hydraulic Forum, which will be held on Tuesday, April 8. Don Morrell, supervisor, Fluids and Electrical Section, Ford Motor Company, will act as chairman. James Robinson, chief engineer, Vickers, Incorporated; Kurt Tech, chief engineer, The Cross Company; and Arthur McHugh, control applications engineer, Lincoln-Mercury Division of Ford Motor Company will deliver papers at this session.

Mr. Morrell is chairman of the recently formed Hydraulics and Hydraulic Machinery Technical Committee, a section of the ASLE General Technical Committee. Members of this committee include: J. C. Hanna, vice president and chief engineer, Hanna Engineering Works; H. Blair, hydraulic engineer, E. F. Houghton & Company; E. R. Lerczak, hydraulic engineer, Oldsmobile Division of General Motors Corp.; O. J. Maha, vice president and chief engineer, Hannifin Corporation; George B. Miller, chief engineer, hydraulic division, Racine Tool & Machine Co.; James Robinson, chief engineer, Vickers, Incorporated; Kurt Tech, chief engineer, The Cross Company; Ernst Weidmann, chief engineer, The Oilgear Company; W. C. Ahlgren, assistant to the vice president, Sundstrand Machine Tool Company and R. A. Schafer, chief development engineer, National Automatic Tool Co., Inc.

Continued on page 116

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You can use this hydraulic quick coupler at oil pressures up to 30,000 psi

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Pioneer Hi-Pressure
Quick Coupler

- This 3/8" Coupler will handle up to six times more fluid than other couplings of equal size with almost no turbulence.
- Perfectly centered steel ball checks give maximum free area, resulting in extremely low pressure drop.
- Guaranteed at 30,000 p.s.i. burst pressure when coupled; each half at 15,000 p.s.i. uncoupled.
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- Using a new "O" Ring groove designed for long life, easy recoupling, and perfect seal.

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"LOGAN" Rotating and Nonrotating AIR CYLINDERS

Fast-Acting, Positive Controlled Power . . . At LOW COST

NONROTATING— 7 STANDARD MOUNTING TYPES

Standard sizes from 1½" to 12" bore; maximum stroke, 18 feet. Special models to meet your requirements.

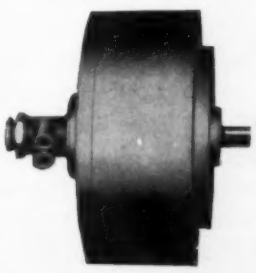
Logan Features—Larger Ports . . . More Sturdy Construction . . . Maximum Power Without Leakage . . . Permanent Seal Around Piston Rod . . . Standard Models With or Without Cushioning.

Nonrotating
Double-Acting Air Cylinder

ROTATING—

Two Standard Styles—Model R with cast iron body; Model K with lightweight aluminum body.

Bore diameter 1½" to 20"; piston stroke 1" to 2"; longer strokes available as special. American Standard adaptations; simple, efficient design to assure positive, rapid, economical operation.



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- HYDRAULIC CONTROL VALVES — CATALOG 200-4
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Continued from page 114

Hydraulic Committee

The Hydraulics and Hydraulic Machinery Technical Committee held an organization meeting in January at which time an agenda of its functions was worked out. The committee determined that it would limit its scope to hydrostatic applications as distinguished from hydrodynamic; that the relation of lubrication and hydraulics was very close and that the JIC Standards would be strongly supported. Through Mr. Weidmann, who is chairman of the Hydraulic sub-committee of the National Machine Tool Builders Association, the services of the committee were offered to appropriate sections of NPA. An agreement to urge the completion of JIC standardization of packings was also reached.

Two sub-committees were named. The first is to propose a Training Program for submittal at the annual meeting. Messers. Robinson, Lerczak and Blair comprise this sub-committee. The other subcommittee was formed to do some preliminary investigation on the standardization of hydraulic components. Mr. Maha, on cylinders, and Mr. Miller, on pumps and valves, will canvass the receptiveness of the hydraulic industry in regard to standardization.

The chairman, Mr. Morrell, pointed out that still wider representation of both builders and users of hydraulic components is desirable on the committee. Further organization work on the committee membership and agenda will be done at the annual meeting, where a separate meeting of the committee will be held.

Other men prominent in the lubrication industry who will speak at the annual meeting include: E. S. Carmichael and R. B. Purdy, Lubricants Section, Socony-Vacuum Oil Co.; C. M. Larson, chief consulting engineer, Sinclair Refining Company; C. A. Bailey, lubrication engineer, National Tube Co.; T. V. Picraux, Lincoln Engineering Co.; D. M. Cleaveland, Bendix Products Division, Bendix Aviation Corporation; L. J. Hibbert and R. F. McKibben, Finishes Laboratory, National Cash Register Co.

KOBE **Heavy Duty High Pressure**

Triplex Pumps

Case History A 4: In August, 1943, the Adel Division of General Metals Corporation installed 3 Kobe Triplexes for testing hydraulic equipment at pressures from 2500 psi to 5000 psi.

The equipment was designated for 2 distinct types of service:

(A) Intermittent operation—production testing of hydraulic equipment for aircraft.

(B) Continuous operation—running destruction tests on new designs.

Convincing proofs of the satisfactory performance of the Kobe equipment are subsequent Adel orders for 3 additional Triplex units—2 installed Sept., 1948, and the 3rd, April, 1951.

When the need is for high pressure hydraulic power "in a package," specify Kobe.

Features:

- **Pressures**—To 5,000 psi (standard) To 20,000 psi (special)
- **Volumes**—To 60 g.p.m.
- **Power Ratings**—15, 30, and 50 H.P.
- **Integral Double Reduction Gears**
- **Integral Electric Drive (optional)**
- **Easily interchanged Plungers and Liners**
- **Built-in Pressure Lubrication**
- **Easily Accessible Ball Type Check Valves**

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KOBE INC., Division of Dresser Equipment Co.,
615 NBC Bldg., 815 Superior Ave., N.E.
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KOBE INC.
Division of Dresser Equipment Co.
Plant: Huntington Park, Calif. — Representatives in CLEVELAND, Pittsburgh, New York, Houston, Oklahoma City.

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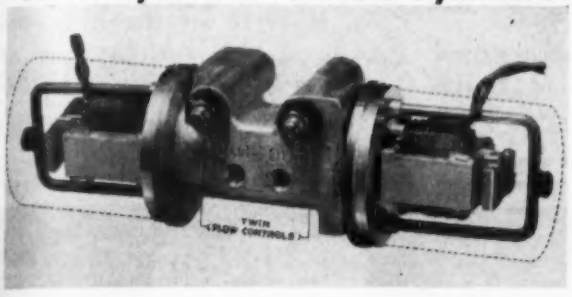
AIRMATIC

301 Standard Models

Air & Hydraulic Valves & Cylinders



Model DDS-4 Direct Double Solenoid 4-Way Valve.

Featuring built in flow controls. One moving part of stainless steel spool design which carries "O" ring seals, capable of handling standard factory air line pressures and low pressure hydraulic oils. Power or fluid pressure failure will not reverse valving or cylinder position.

ATTRACTIVE O.E.M. and QUANTITY DISCOUNTS
DELIVERY FROM STOCK — IMMEDIATE

Also available for immediate delivery 3-Way & 4-Way Single Solenoid Valves — *Write for full details*

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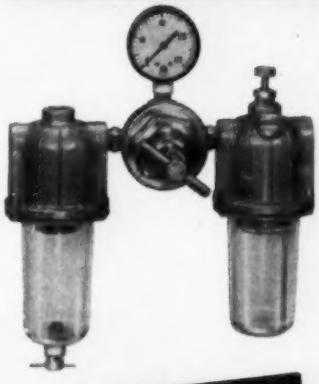
NOW IMMEDIATE DELIVERY — GOODYER PUR-LUB-AIRE UNITS



RECENTLY EXPANDED FACILITIES ASSURE IMMEDIATE DELIVERY

NOTE: Few distributor territories still open—ask for details.

Write for literature

A mechanical and scientifically advanced principle for purifying, lubricating and regulating compressed air.

. PUR-LUB-AIRE combines three units and functions.

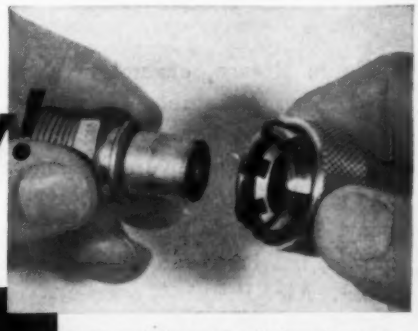
1. PUR-O-FIER — Purifies air from source. Removes scale, moisture and excess oil from compressed air lines.
2. PUR-O-LUBER—Introduces finely vaporized oil into lines. Offers controlled mixture of air and finely atomized oil to desired ratio. Special design permits oil mist to impinge on any surface reached by the compressed air.
3. REGULATED AIR PRESSURE — of discharge air is accurately controlled with no creep on gauge and minimum fluctuation from initial pressures.

Discharge pipe sizes: 1/4"; 3/8"; 1/2"; 3/4"; 1"; 1 1/4"; 1 1/2"; 2"; 2 1/2"; 3". 1 cfm. to 1000 cfm. air volume. Available in combination or separately — Manual or Automatic.

AIR CONVERSION RESEARCH CORP.
4113 N. Damen Avenue, Chicago 18, Ill.

Throw your wrench away!

CONNECT or DISCONNECT any fluid or electric line *without a wrench*



PULL and the mating halves disconnect.

Wherever fluid or electrical lines must be joined or separated easily and quickly, you can rely on *WIGGINS Inst-O-Matic couplings*. No wrench; just use your fingers.

If you use couplings on fuel, oil, hydraulic, electrical, pneumatic, oxygen, acid or water lines, you can use this cost-cutting coupling.

PUSH and the mating halves connect. Especially useful in hard-to-get-at places.

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WIGGINS Inst-O-Matic couplings can reduce your costs. Write today. There's a qualified representative near you.

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POST SCRIPTS OF INDUSTRY

NEWS · VIEWS · TRENDS

The appointment of **Robert F. Hodgson** to the position of vice president of **Hydraulic Equipment Company,** Cleveland, Ohio, was announced by the company's president, Hall Kirkham. Formerly sales manager and chief engineer, Hodgson joined the firm in 1945 as a sales engineer. He is currently an active member of the Society of Automotive Engineers and was graduated in 1940 from the Case Institute of Technology.

R. F. Hodgson

Borge Rosaen, general manager of **Dudco Products Company,** Hazel Park, Michigan, manufacturers of vane-type hydraulic pumps and motors, announces that his company, including all patents and facilities, has been sold to **The New York Air Brake Company** of New York. It will be known as the Dudco Division, under the new parent company's name. There are no changes in personnel or in the operation of the plant under the new owners.

J. A. Wilson, Jr. has been named supervisor of design and drafting for the **C. A. Norgren Co.,** according to D. G. Faust, chief engineer of the concern. Mr. Wilson joined the Norgren Co., a year ago as a design engineer, after ten years of mechanical engineering experience with aircraft and other industrial firms.

A. W. Laird has been elected vice-president in charge of the Hydraulic Division of **The New York Air Brake Company.**

C. A. Howe, president of **Hill-McCanna Company,** Chicago, announced that the company has acquired a substantial financial interest in **Air Conversion Research Corp.,** makers of air filter equipment.

Aeroquip Corporation, Jackson, Michigan, announces the appointment of **Byron E. Snow** as manager of the company's new Chicago office, 1033 South Boulevard, Oak Park, Illinois.

SPRAGUE HYDRAULIC BOOST PUMPS

FROM 3500 TO 50,000 PSI.

Assembly No.	Ratio	Recommended Air Pressure	Maximum Fluid Pressure
216-C- 35	35:1	100 PSI.	3,500 PSI.
216-C- 60	60:1	100-150 PSI.	6,000 PSI.
216-C-100	100:1	100-150 PSI.	10,000 PSI.
216-C-150	150:1	100-150 PSI.	15,000 PSI.
216-C-200	200:1	100-150 PSI.	20,000 PSI.
216-C-300	300:1	100-150 PSI.	30,000 PSI.

6 Standard Models for Output Fluid Pressures to 30,000 PSI. From 100-150 PSI. Plant-Supplied Air Pressure. Boost Pumps with Capacities to 50,000 PSI. Supplied on Special Order.

Model 216-C measures 8¼" wide, 9⅜" deep

Broadly applicable for static testing, powering presses for metal forming, shearing, clamping, etc. This standard model available for either oil or water service, where low volume output at high pressure is the requirement. Thousands in use. Simple... Reliable... Inexpensive.

SPRAGUE GAUGE PROTECTOR SHUT OFF VALVE

Automatically cuts out gauge from system when hydraulic or pneumatic pressure goes beyond its operating limit. Automatically opens when pressure is again within operating range of gauge. Available for low pressures — 30, 60, 100, 200 and 300 PSI. and high pressures — 500, 1000, 1500, 2000, 2500, 3000 and 5000 PSI. Finest construction. Individually tested and approved. Write today for bulletin.

REPRESENTATIVES—New York, Philadelphia, Cleveland, Dayton, St. Louis, Chicago, Logansport, Dallas, Seattle. CANADA—Exclusive Distributor: Rousseau Controls, Ltd., Montreal Airport, P. Q.

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SPRAGUE Engineering and Sales Corp.

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Circle 121 on Reader Service Card

QUALITY — A CARDWELL TRADITION SINCE 1829

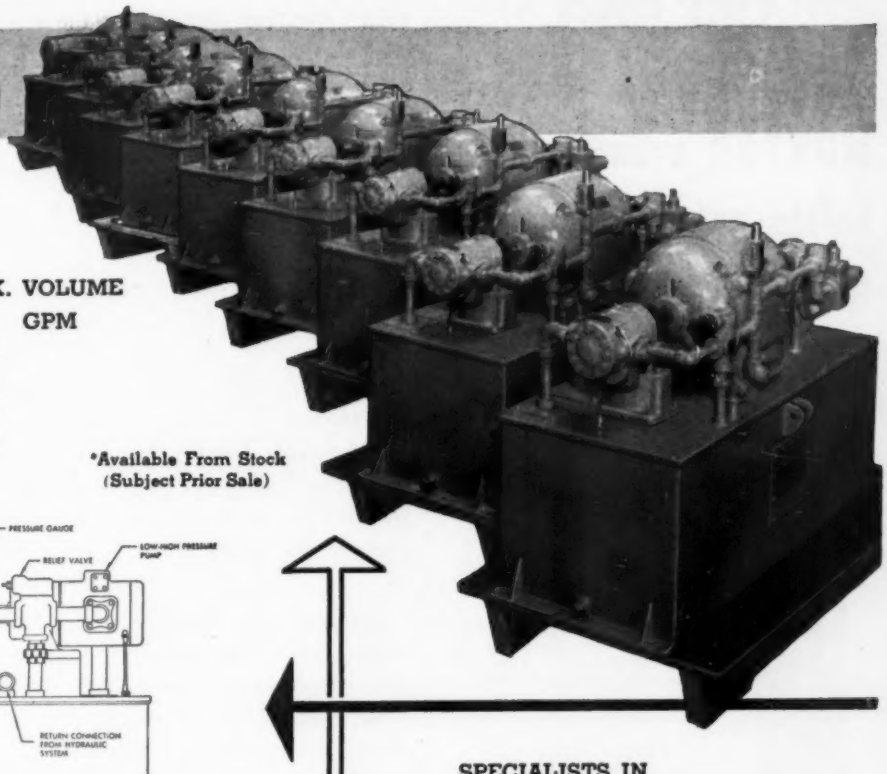
CARDWELL

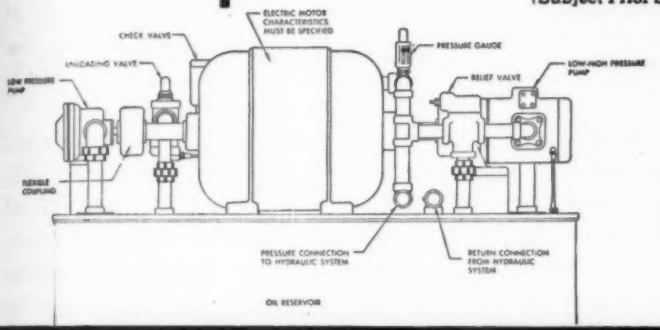
SRD ROTARY HYDRAULIC POWER UNITS

PRESSURES UP TO 2000 PSI

MODEL	MAX. VOLUME
SRD 1 -	12.2 GPM
*2 -	17.8
3 -	28.3
4 -	41.9
*5 -	51.8

*Available From Stock (Subject Prior Sale)





SPECIALISTS IN CUSTOM BUILT HYDRAULIC POWER UNITS

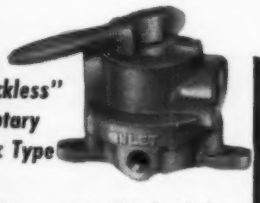
The CARDWELL MACHINE COMPANY

Franklin at 19th St. • Richmond 11, Virginia • Phone: 7-2985

Positive Air Control with HANNIFIN VALVES

for single or double-acting cylinders

Hannifin precision-built valves are efficient and *reliable*—and quickly *available!* For positive, accurate control of air-powered equipment, there is a Hannifin valve that will give long-time service in production operations.

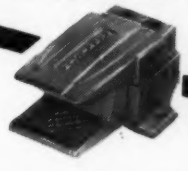


"Packless" Rotary Disc Type

Hand operated. Simple design avoids leakage, waste of power—gives positive control. Sizes ⅛" to 1¼".

Also foot-operated types—leave operator's hands free. Sizes, ¼" to ¾".

"Effortless" Sliding Disc Type



Foot operated. Fast, effortless action. Pilot operated, air pressure does the work.

Also finger-tip actuated models.

Write for Bulletins 57, 240, 241

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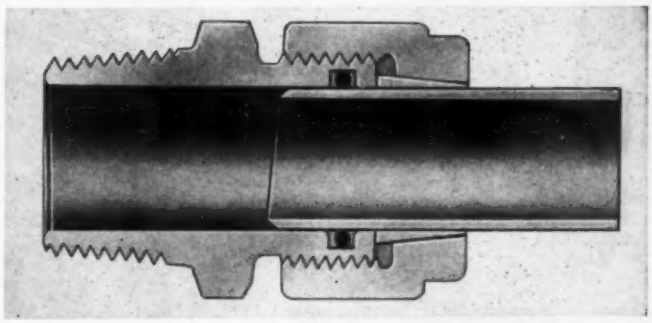
LENZ "O-RING" TUBE COUPLINGS



Eliminate Flaring . . . Threading Welding . . . Soldering

- Seal and grip are separate
- No metal to metal seal
- No exact tube length necessary
- Not necessary to cut tube square
- No concentration of stresses due to flares or ferrules for tube failures.
- Fast Installation — No tools required but a wrench.

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LENZ COMPANY

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FOR HIGH PRESSURE LOADS..

MUNTON cylinders and valves safely handle all loads up to 5000 p.s.i.

5000 P.S.I. HYDRAULIC CYLINDER

1. SPACE SAVING 4" cylinder at 5000 PSI develops 60,000 lbs. pressure. An 8" cylinder at 1000 psi develops only 50,000 lbs.

2. ALL-STEEL construction.

3. Sizes: 1½" to 6" ID.

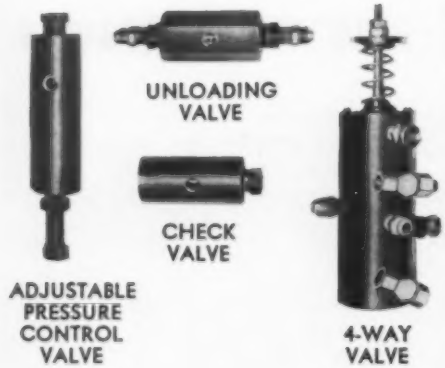
4. The only cylinders with FELT WIPERS on BOTH ENDS of piston, ahead of the piston rings, to wipe the walls of the cylinder as the piston moves in either direction . . . insuring LONGER LIFE and reducing chances of scoring.

5. A double seal arrangement, with port for a drain-back to tank, to eliminate annoying seepage around piston rod.

6. Munton Special "V" type combination rubber and leather packing to insure lubrication along with sealing.

7. Chrome-plated piston rods; long piston for ample bearing surface; cast-iron piston rings; and all JIC features.

8. Valves include: 4-Way; adjustable pressure control; safety valve; check valve; unloading valve; and sequence valve. All-steel construction eliminates danger of sand from cored holes working loose and getting into system to score cylinders and valves. All valves made for 5000 PSI.



Hy Speed DRAULIC TOOLS
FOOT AND MOTORIZED HYDRAULIC PRESS
HYDRAULIC VISES
MOTORIZED PLASTIC INJECTION MACHINE
MOBIL-POWR AND HYDRAULIC RAMS
FOOT POWER UNITS
MUNTON MFG. CO.
9400 W. BELMONT AVE. • FRANKLIN PARK, ILL.
Phone: Gladstone 5-2618

Circle 122 on Reader Service Card

William J. Katt of St. Louis has been appointed manager of the design section of **Monsanto Chemical Company's** General Engineering Department. It was also announced that **George B. Boon** has been appointed assistant manager of the design section.

Compressed Air Products announces that **T. H. Eliades,** who has been office manager of their Maplewood, New Jersey office, has reenlisted in the Navy as a lieutenant, j.g. Mr. Eliades has been assigned to the cruiser Quincy. **R. M. Gaudet** has joined the company to replaces Mr. Eliades.

Richard E. Palmer has been named assistant to Burnham Adams, sales manager of **AiResearch Manufacturing Company,** Los Angeles. Palmer has been assigned to administrative duties pertaining to established customer orders and general business affairs of the AiResearch sales department.

Airmatic Valve Inc. Acquires New Plant

Airmatic Valve, Inc. manufacturers of automatic air valves, air and hydraulic cylinders, have moved into a new manufacturing plant located at 7317 Associate Avenue, Cleveland 9, Ohio.

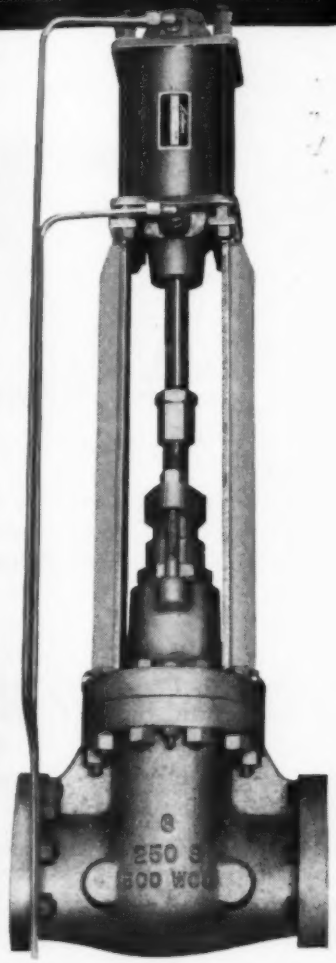
The new plant includes a complete, newly equipped engineering and research department for developing and improving products and extending their application in industry, and also to broaden the scope of Airmatic's engineering services for tailoring air controlled valves to satisfy special requirements.

Modern fabricating equipment has been planned and arranged to facilitate more prompt delivery of all types and models of Airmatic components. Efficient plant planning has also included a final inspection department which will further assure trouble-free performance of equipment.

PROMET COMES TO THE RESCUE
TEMPORARY LUBRICATION FAILURES NEEDN'T BE EXPENSIVE
Medium and High-Lead
PROMET
THE Engineered BRONZE
BRONZES
No. 1, No. 2-S, No. 6, No. 6-SK,
carry on until lubrication can be restored.
Hard and strong enough to take the constant pounding of heavy shock loads and high compressive forces, these Promet Bronzes are also sufficiently high in lead content, soft enough, to prevent seizure and to embed harder particles that would ordinarily result in scoring.
Easily machined at high speeds without lubricants or coolants.
Write today for service data sheets and quotations.
THE AMERICAN CRUCIBLE PRODUCTS CO.
1303 Oberlin Avenue • Lorain, Ohio, U.S.A.

Ledeen

VALVE ACTUATORS



For Power Operation of All Types of Valves

Ledeen Valve Actuators are particularly adaptable for labor saving, or remote control of inaccessible valves. They can be adapted to any make, size, and type of valve to operate against any line pressure—for any fluid medium—with any pressure. Can be arranged for on-and-off, or positioning service. Positive in action, economical in cost

Write for Bulletin 512

Ledeen Mfg. Co.
1610 So. San Pedro St.
Los Angeles 15, Cal.

Circle 57 on Reader Service Card

George H. Elder, Jr., formerly with Gerotor May Corporation has joined **Van Zelm Associates** of Baltimore, Md. Mr. Elder assumes the duties of design engineer specializing in hydraulic systems.

The appointment of **U. & S. Inc.,** Syracuse, N. Y. as sales representatives for central and eastern New York State, has been made by the **American Flexible Coupling Company,** Erie, Pa. The firm will handle the "Amerigear" and "American" couplings for power transmission in the territory.

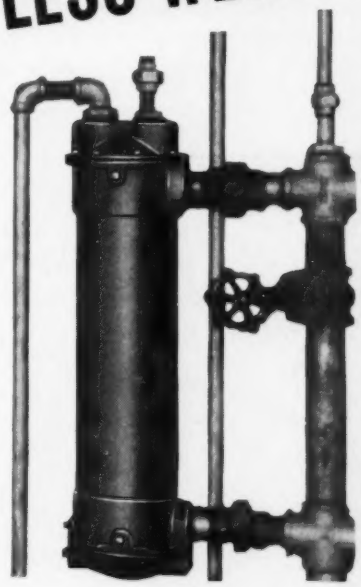
R. B. (Dick) Hazard has been appointed sales manager of the Packing Division, **Raybestos-Manhattan, Inc.** He will make his headquarters at the Manheim, Pa. plant. His experience has been wide and varied. From 1934 to 1941 he represented B. F. Goodrich Company in St. Paul, Minn. From 1941 to 1943 he was associated with W. S. Nott Company, Minneapolis. With R/M since 1945, Hazard, in 1949, was advanced to manager of Distributor Sales, Western Division, of Manhattan Rubber Division with headquarters in Chicago.

Ferdinand Pauls has been appointed assistant advertising manager of **Jas. P. Marsh Corporation,** Skokie, Illinois. Mr. Pauls, a graduate of Northwestern University, has been active in the Marsh sales department for about ten years.

The Cleco Division of the Reed Roller Bit Company, Houston, Texas, has announced the appointment of **George W. Sassady Company,** Sylvan Dell Road, Williamsport, Pa., **Davenport Engineering Company,** 415 West Third Street, Davenport, Ia., and **Monogram Air & Power Equipment, Inc.,** 125 Olive St., New Haven, Conn., as distributors for Cleco products in their areas.

ARE YOU GETTING

MORE COOLING WITH LESS WEIGHT?



YOUNG HEAT EXCHANGERS ARE SELECTIVELY ENGINEERED TO THE JOB . . . . . .

● Where compact, lightweight heat exchangers are important, it will pay to check the Young line. For example, the new A-800 shell and fixed tube bundle units through efficient design and precision manufacture offer equivalent heat transfer with up to 40% reduction in size and weight!

Let us prove these economies to you on your specific application. Incidentally, we believe you'll be pleasantly surprised at our prompt quotations, quick deliveries, and low first cost.

YOUNG RADIATOR CO.
Heat Transfer Products for Automotive and Industrial Applications. Heating, Cooling, and Air Conditioning Products for Home and Industry.
Dept. 442-C, RACINE, WISCONSIN
Factories at Racine, Wisconsin and Mattoon, Illinois

Circle 120 on Reader Service Card

Hanna Engineering Works, Chicago, has announced the appointment of **Power Transmission Products Division** of Portland Iron Works, Portland, Oregon, as distributor for Hanna pneumatic and hydraulic cylinders and valves in the state of Oregon and certain counties in California and Washington. Guy B. Arthur is sales manager of Power Transmission Products located at 1107 N.W. 14th Ave., Portland 9, Oregon.

Richard D. Maystead, vice president of manufacturing and director of engineering, **Pacific Airmotive Corporation,** announced that George Williams has accepted the position of quality control manager, Manufacturing Division.

Aeroquip Corporation, Jackson, Michigan, has terminated arrangements with its Southwest distributor, Aeroquip Sales and Engineering, Inc., Fort Worth, Texas. Aeroquip's customers throughout the new territory covering 14 states will be contacted directly by specially trained sales engineers operating from Aeroquip Corporation and its wholly owned subsidiary, Aero-Coupling Corporation, Burbank, California.

Edward M. Greer, president of **Greer Hydraulics, Inc.** announced the appointment of **Arthur K. Atkinson, Jr.** as sales manager of the Industrial Division. Mr. Atkinson, with a background of practical engineering, marketing and product development will supervise the national sales of the Greer hydro-pneumatic accumulators and other hydraulic devices and components.

A. K. Atkinson, Jr.

D. W. Holmes, vice president of **The Parker Appliance Company,** Cleveland, announces the appointment of Wallace Tube Company, 838 South 6th Street, Milwaukee 4, as an authorized warehouse distributor for Parker tube fittings. Aero Bolt & Screw Company, Inglewood, California, has been appointed distributor for O-ring seals manufactured by The Parker Appliance Company.

Adin B. Capron has been named to the newly created post of chief engineer of the Tubular Products Division of **The Babcock and Wilcox Company.**

Joseph W. St. Lawrence, formerly hydraulic service engineer for Le Maire Tool and Manufacturing Company of Dearborn, Michigan and before that hydraulic sales and service engineer for the Vinco Corporation in Detroit has formed the **St. Lawrence Hydraulic Company** in Dearborn, which specializes in engineering and installing hydraulic power equipment.

the Winner and still CHAMPION!
GRC
FINAL
GRC "O" RING FLOORS FRICTION
Champ Comes Through In Rugged Test
Breakout . . . Seizure . . . Strain . . . Adherence . . . everything in Friction's book was thrown at GRC "O" Ring to no avail. From the opening bell the champ's heredity and background were apparent. All of GRC's technical skill, laboratory controlled processing standards and rigid inspection were pointed to this event and paid off in sealing Friction's doom.
Ring-wise observers say they have never seen anything like GRC Champ "O" Ring's performance and were unanimous in giving him the seal of approval.
CHAMP-O-RING
OTHER CROWNING ACHIEVEMENTS OF GRC CHAMP "O" RING
In bout after bout GRC "O" Ring has earned a clear-cut decision over: high static pressures, reciprocating pressures, shocks, surge, drop and vacuum. Delivers a "one-two" knock-out punch against High-Temperature with GRC -380° Buna N and -500° Silicone stocks. Tames "Killer" Twist with GRC compound No. 1052 (MIL-P-5516).
If you want GRC Champ "O" Ring in your corner write for free Catalog "C".
Goshen Rubber Company INC.
MOLDED • DIE CUT • LATHE CUT RUBBER SPECIALTIES SINCE 1916
1532 S. TENTH STREET • GOSHEN, INDIANA
Circle 37 on Reader Service Card

Marvin J. Parks, sales manager for Air **Associates Manufacturing Divisions** has announced the promotion of **Price Phelps** to assistant sales manager of the company's Aircraft Products Division at Teterboro, N. J. Phelps joined Air Associates in 1947 as a sales engineer for the company's electro-mechanical and hydraulic products.

Parker Holds Sales Conference

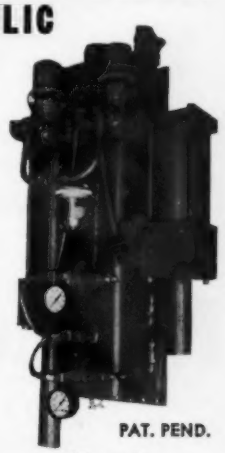
How 12,700 psi of hydraulic pressure has burst steel tubing without effect on the Parker Appliance tube connectors is pointed out by D. W. Holmes, vice president in charge of sales, to distributor representatives attending the company's annual industrial sales conference held in January in Cleveland. D. A. Cameron, left, Parker fittings division sales manager looks on with Clayton Grover, v.p., Whithead Metal Products Co., with headquarters in New York, and Carl S. Abbott, v.p., J. N. Fauver Co., Detroit.

The distributor and industrial group totalling 108 heard how the company's expansion program had boosted Parker Industrial fittings output to the highest point ever, 5½ times the pre-Korea level. Over the past two years, Parker, world's largest manufacturer of tube fittings, has spent $5,500,000 in an expansion program to keep production of both industrial and aircraft equipment abreast of requirements.

Circle 19 on Reader Service Card

NEW CENTURY

AIR POWERED OIL HYDRAULIC BOOSTER



. . . offers you a complete, simple power package for developing high hydraulic pressure from ordinary shop air supply. The package comes complete with oil tank, air regulators and solenoid operated control valves for stroke reversal.

PAT. PEND.

30 cu. in. Double-Acting air hydraulic booster

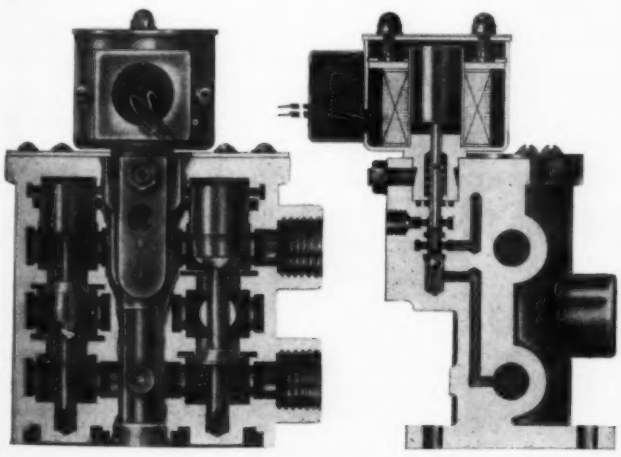
Over fifty of these 30 cu. in. air-hydraulic boosters are powering welding operations in one of the Big Three automobile plants. Their time saving operation has proven to be maintenance free.

FOR COMPLETE DETAILS WRITE TO:

Century Hydraulics

19401 WINTHROP • DETROIT 35, MICH.

CRESCENT 4-WAY 2-POSITION VALVE



PILOT OPERATED • SOLENOID CONTROLLED

AIR • WATER • LIGHT OIL • TO 150 PSI

May be operated continuously up to 600 cycles per minute, thus affording precise control at any cycling rate. Resilient seats assure positive seal, are not critical to dirt.

As high as 42 million cycles recorded at 600 c/m without maintenance

Write for Bulletin 1046

BARKSDALE VALVES

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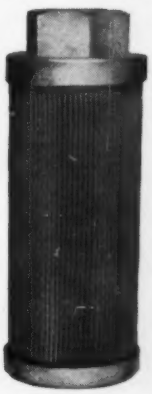
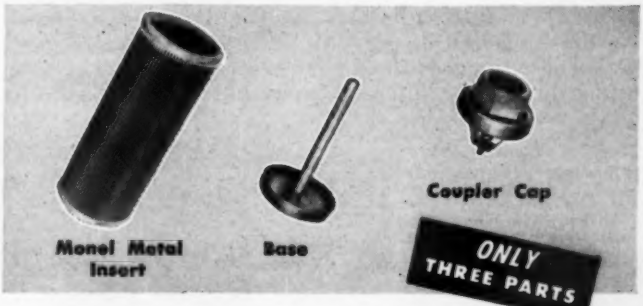
CAPITAL HYDRAULIC OIL FILTER

Easy To Install and Maintain



Avoid costly breakdowns with the new Capital hydraulic reservoir type oil filter which features a non-corrosive, trap-weave wire cloth, giving clean oil at an extremely low pressure drop. Get full protection — various sizes of filter screens can be interchanged in minutes — can be cleaned without taking apart. Its greater filtering area traps all foreign particles and helps to keep your equipment running at top efficiency.

Capital filters designed to J.I.C. standards are available in filtering capacities of 5, 10, 20, 30 and 50 gals. per minute. Larger capacity sizes can be supplied to meet special requirements. Get bulletin AH-1 for complete details.



CAPITAL

Select territories are available to progressive distributors. Inquiries invited.

ENGINEERING & MFG. CORP.

5837 South Ashland Ave. • Chicago 36, Ill.

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NEW BOOKS

Nomographic Charts

By **C. Albert Kulman;** *244 pages, 7x10, published by McGraw-Hill Book Company at $6.50.*

When working a series of similar problems, one of the most valuable time savers is a nomographic chart. Mr. Kulman presents 92 such charts which he has prepared and used during many years of engineering work. These charts are reproduced for very quick reference and use.

Each chart appears on a large 7x 10 inch page opposite a page of explanation which details the formulas from which the chart is developed, and gives a procedure for the use of each chart. The charts, most of which are intersection or combination intersection and alignment nomographs, are accurate beyond slide rule computation.

Six groups of charts speed computation of general functions; and problems in hydraulics, mechanics, thermodynamics and electricity.

New Edition Hydraulic Institute Standards

The new ninth edition of the Standards of the Hydraulic Institute is ready for distribution. The first edition since 1948, this authoritative volume contains a considerable number of revisions, particularly in the centrifugal pump and in the reciprocating pump sections. The volume also contains sections on rotary pumps, definitions, standards, a data section and a very complete section on pipe friction. Each section is indexed separately, the three pump sections also have a separate index to their respective Test Code. Test Codes are given in full in each pump section.

The sections are each self contained and complete — for example, the pump sections contain design, installation, operation and trouble shooting data; the pipe friction section contains a very complete set of charts for pipe, valves and fittings, illustrative examples, installation data and diagrams, viscosity of fluids charts and a bibliography.

Copies of the Standards may be obtained on request to the Hydraulic Institute, 122 East 42nd St., New York 17, N. Y., at $3.00 per copy.

"Vibration and Shock Isolation"

By **Charles E. Crede,** *chief engineer, The Barry Corporation, Watertown, Mass. 328 pages, 181 illustrations, Published by John Wiley & Sons, Inc., at $6.50.*

This is the first thorough study of the science of protecting equipment and machinery against vibration and shock by the use of resilient supports. Written primarily for the practicing engineer, the book is concerned with the basic mechanics of isolation and, while the analytical treatment of certain problems will be of value to students having special interests,

MULCONROY

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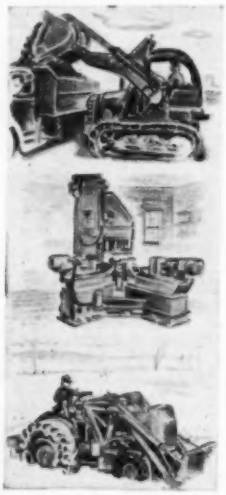
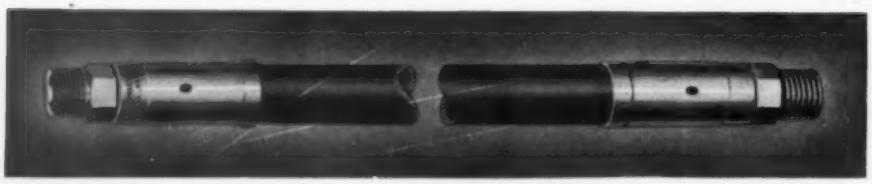
HOSE ASSEMBLIES

Complete units, ready for quick, easy installation on all types of hydraulic equipment. Available in three basic hose constructions to meet all required working pressures. Full range of sizes; lengths to 50 feet.

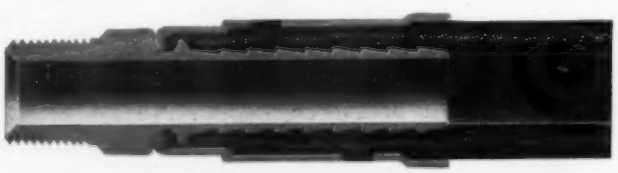




With **"PRESS-LOCK"** *Couplings*

The "PRESS-LOCK" is based upon an entirely new coupling-to-hose anchoring principle which assures strength, durability and safety unequalled in any other coupling of the pressed-on type. The hose itself provides a major portion of the coupling's tremendous holding power through its displacement inside the coupling sleeve. Because the *entire hose wall* is utilized—for the full length of the coupling —hydraulic hose equipped with "PRESS-LOCK" couplings will withstand shock loads and continuous flexing far beyond the limits of hose connected with conventional pressed-on fittings. Literature available.

Right: Cut-away view showing unique construction of "Press-Lock" Coupling. Note that entire hose wall is employed.



"MULCONROY *Starts...* WHERE OTHERS *Stop!*"

MULCONROY CO. *Hose Specialties Since 1887*

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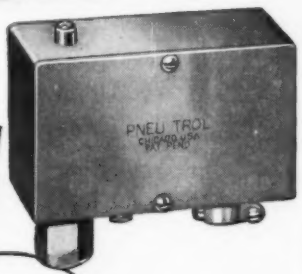
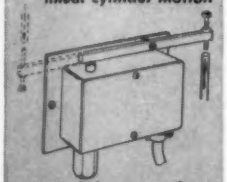
Circle 85 on Reader Service Card

NEW Industrial Time Delay Switch for Cylinder Operated Motions

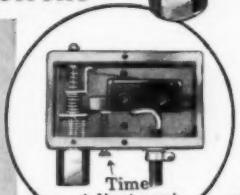
- ★ Simple, Foolproof
- ★ Low Cost
- ★ Positive Time Control
- ★ For Mounting at End of Cylinder Stroke



Switch mounting for lineal cylinder motion



Switch arranged for vertical motion of cylinder



Range ½ to 10 Seconds

Pneu-Trol Time Delay Switches are complete, self-contained units, combining the switch and dwell . . . are compact—3¾" x 3⅞" x 1¾" . . . easily mounted at the cylinder—quickly adjusted to produce ½ -10 second time dwell of solenoid operated air or hydraulic cylinders. Automatically reset after actuation. Ideal for controling machine movement in blind hole drilling and tapping, tool finishing, step drilling, spot facing, chamfering, beading, spinning, etc.—for time control in process work, such as plastic printing, rubber and plastic curing, burnishing, coating, quenching, dipping, etc. Also widely used for dwell in fixture loading and unloading when using continuous automatic motions. *Write for Illustrated Circular and Prices.*

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. . . Another case of "a good thing in a small package"! Users are amazed at the ruggedness and unusually large capacity of Skinner Valves—they're tiny but mighty, with a standard range for gaseous or liquid media from 5 to 250 p.s.i., and special from 5 to 850 p.s.i. Their soft insert seat prevents leakage and positive action is assured by spring loading. Skinner Valves may be used in any position, with pipe connections furnished to suit specifications. Power consumption is 10 watts max. Special coils for high humidity or high temperature applications can be supplied. Standard models are approved by Underwriters' Laboratories. *Write for Bulletin No. 501.*

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THE SKINNER CHUCK COMPANY
142 Belden Ave., Norwalk, Conn.

SAVE UP TO 85% in WAR SURPLUS HYDRAULICS

SPECIAL BARGAIN #29 HYDRAULIC CYLINDER

Gives 20,000 lbs. thrust (push pull) using 1500 PSI line pressure as obtained from our hyd. pumps. Or will produce 40,000 lbs. thrust with 3,000 lbs. line pressure. CAN ALSO BE OPERATED ON LOW PRESSURE AIR SYSTEMS. 4" Bore, 1½" dia. piston shaft, 18" stroke, length 30½". Equipped with ball bearing loaded clevis type mounting and swivel type high pressure steel pipe bracket for easy use. Ideal for road farm and shop machinery, presses, etc. Cost Government $390.00 . . . . . NOW **29.95**

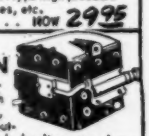
3A HYDRAULIC CYLINDERS

NO. 3A – Bore 1½", Shaft ½" Stroke 5", Length 10½" . . . **7.75**
NO. 9E – Bore 1-3/8", Shaft 1" Stroke 15-5/8", Length 15¾" . . . **9.75**
NO. 35 – Bore 1½", Shaft 1" Stroke 26", Length 23½" **16.50**

AN-Hi-Press. HOSE (FUEL–OIL & AIR)

1/4" Tube Size – 7/16 x 20 Thread – 16" long with Male and Female fitting at either end. . .95¢ each.
1/4" Tube Size – 7/16 x 20 Thread – 22" long with Female fittings at both ends. . . . . .95¢ each.
3/8" Tube Size – 9/16 x 18 Thread – 20" long with Female fitting at both ends. . . . . $1.90 each
Same as above but 63" long. . . . . $3.75 each
1/2" Tube Size – 3/4 x 16 Thread – 24" long with Female fittings at both ends. . . . . $2.45 each
Same as above but 63" long. . . . . $3.75 each
5/8" Tube Size – 7/8 x 14 Thread – 15" long with Female fittings at both ends. . . . . $2.25 each.

HYDRAULIC TRANSMISSION



Self contained, 2 H.P. constant torque at all speeds with variable volume reversible, piston pump (controlled by outside lever.) supplying piston hydraulic motor. Automatic pressure, Dash pot for smooth control. Power output R.P.M. – 0 to 1/3 input R.P.M. in both directions. Input R.P.M. 1800 continuous 4000 intermittent. Dash pot can be removed for greater R.P.M. Ideal for Lathes, Duplicator Setup on Mills, Conveyors, Small Cars, Drives, Gearing, etc. Includes 2 - 4" Spline Shafts for input and power take-off. Cost Government approx. $400.00 **37.50**

HYDRAULIC PUMPS

ANGLE PUMP
Positive displacement type, angle piston. Displaces .507 cu.in. per revolution. Has capacity of 6 gal. per minute at 3000 RPM at 1500 PSI continuous 1875 for 15 seconds. Operating speed of 3750 RPM, intermittent maximum 4500 RPM. Rotates to the right only. **19.49**

P-3 STRATO POWER PUMP With built-in variable flow control valve in head. Positive displacement piston type. Displaces .450 cu. in. per revolution. Two gal. per minute capacity at 1500 RPM at 1250 PSI. Pressure limit, 1250 PSI continuous. 1400 PSI for 15 seconds. Operates at 3750 RPM, intermittent max-4500 RPM. Rotation either direction without adjustments. **17.50**

FOUR WAY VALVE

V-17 Poppet type. Pressure balanced. Off at neutral position. Piston type with built-in relief valves for limit of cylinder strokes. Has 5/8" AN tube size (7/8"–14 thread) inlet and outlet. Ports to the cylinder are 1/2" AN tube size with 3/4"–16 thread. Many more in stock. Send for list. **9.75**

NEW HYDRAULIC ACCUMULATORS

A–28 FLOATING PISTON TYPE – 4" dia. X 18" long. Handles pressures up to 2000 lbs. X'int. Cond. **12.75**
4-5 VICKERS – 10" dia. Built to stand 2,000 PSI. **19.75**
Accumulators are used for constant pressure both in line and reserve storage for instant use to take the lag from the pumps.

We carry the World's Largest Supply of New Hydraulic Equipment featuring over 20,000 Cylinders in 61 Sizes & Types. Can also supply all accessories such as Pumps, Fittings, Valves, Tanks, Hose Fittings. Let us solve your Hydraulic problems. Write for inform.

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- ☆ QUICK CONNECTING
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IMPORTANT FEATURES

* FOR MANY VARIED INDUSTRIAL USES:

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- Petroleum loading valves and connections
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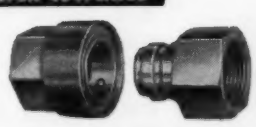

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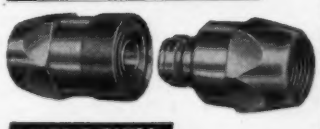

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Features like these mean CONNECT WITH ROYLYN!

- ★ *SIZE RANGE* . . . ⅛ inch to 2½ inches. Up to 6 inches in some styles.
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- ★ *POSITIVE LOCK* . . . Locks with a "snap" and positively will not uncouple with vibration, pressure or rotation of the connected hose.
- ★ *SAFETY* . . . Laboratory tests for extremes of heat, cold, vibration and years of hard service have proven its rugged reliability.
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There is a Roylyn Coupling available for practically any type of flexible connection for air, water, hydraulic and chemical applications. Write today for free illustrated catalog and nearest dealer. Inquiries regarding available dealerships are invited.

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many practical discussions on the design and applications of isolators are included.

The treatment sticks strictly to the principles and applications of isolation; it does not compete with existing books on general vibration theory and practice. The six chapters cover: (1) introductory, devoted to a discussion of mathematical and physical concepts used in later chapters; (2) and (3) basic discussions of principles of vibration and shock, respectively; (4) supplementing chapters 2 and 3, with discussion of nonlinear and damped systems, the latter in both a theoretical and a practical sense; (5) properties of materials in common use as the resilient media (natural and synthetic rubbers, metal springs, felt, cork, etc.) in vibration and shock isolators; and (6) specific applications of isolations, both industrial and military.

This book should be valuable as a working guide to the practicing engineer who must solve vibration and shock problems.

Servomechanisms and Regulating System Design

By **Harold Chestnut** *and* **Robert W. Mayer,** *Aeronautics and Ordnance Systems Divisions, General Electric Company. 506 pages, 295 illustrations. Published by John Wiley & Sons, Inc. at $7.75.*

This text is designed to give a thorough grounding in the principles of feedback control and is intended for practicing engineers and engineering students who have not had previous experience or training in the field of closed-loop control systems. Starting with the basic mathematics involved, the nature of the physical problems are clearly described; the emphasis is on the feedback control concept for regulators and servomechanisms, Both the differential and Laplace transform methods of solving transient problems are briefly presented; current theory and system stability are presented; closed-loop control system elements, operation, performance and methods of analysis are described. The practical approach to system synthesis is emphasized throughout.

ONLY *Hydromotor* (patented)
GIVES YOU THESE ADVANTAGES

1 *Reciprocating* Rotary Power
2 *Equal* Torque in *Both* Directions
3 Rotates 280° or *Any* Selected Portion Thereof
4 May Be Stopped or Reversed, Speeded Up or Slowed Down by Simple Controls
5 Free of Gears or Linkage
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8 Often *Saves* Space, Parts, Weight
9 Standard Models Available for 1500 to 200,000 inch pounds of torque at 1000 psi.

Used for: LIFTING • LOWERING • REVOLVING • SWINGING • TURNING • OPENING • CLOSING • CLAMPING • INDEXING, etc. Better investigate this fully-proven and versatile hydraulic actuator now.

WHAT POSSIBLE APPLICATION HAVE YOU ?

Hydromotor DIVISION
The Bonnot Company — Canton 2, Ohio

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THE MARKET PLACE

Classified Advertising

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Vickers Hydraulic Pumps
2 ea. Model V468D and V104D2
1 Model VC138D-6DD-2
Excellent condition. Further information contact Purchasing Dept., G. E. Elmira Works, Elmira, N. Y.

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wanted in principal cities to handle complete, quality line of air and hydraulic cylinders and valves. In your reply state lines being handled and territory covered. If present capacity does not fit that of above give experience in field and present position. All replies in strictest confidence. Box 3152, APPLIED HYDRAULICS.

Another Job for Pesco HYDRAULIC MUSCLES

Hough Model HF PAYLOADER lifts awkward chunks of concrete in confined quarters with sure, positive control.

High, sure lifts are made possible by the rugged Pesco hydraulic pump.

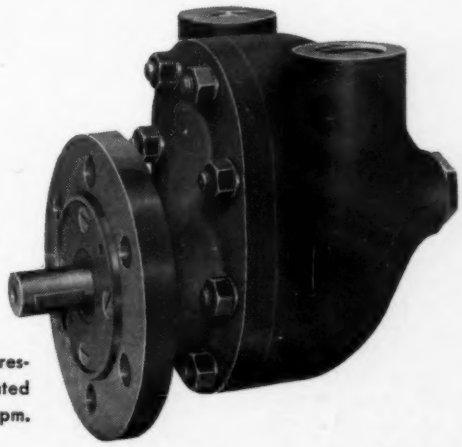
Positive Pesco Power for Lift, Tilt, Dump

makes close-quarter work easy for a **PAYLOADER®**

Hough PAYLOADERS, well known for their versatile, dependable performance rely on a small Pesco hydraulic pump as the heart of the hydraulic bucket control system. Power to spare is always on hand. The minute power is needed to dump, lift or tilt the bucket, it's there . . . right at the operators' finger tips.

Countless pumps on countless jobs, serving in all kinds of rugged conditions have made Pesco pumps famous for their dependable, trouble-free service. Behind the dependability of Pesco hydraulic equipment are years of research and practical know-how.

This knowledge can be of benefit to you. Write today stating your hydraulic problems. We will be glad to help.



Hydraulic pump Model 051006, gear type, pressure loaded with positive displacement. Rated capacity; 15 gpm at 1000 psi and 1200 rpm.

engineering Pesco production

PRODUCTS DIVISION

BORG-WARNER CORPORATION

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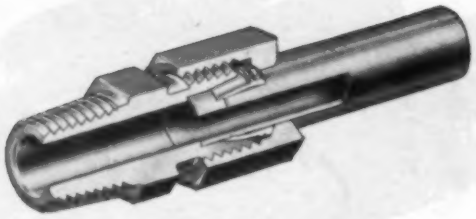
WANT HYDRAULIC CONNECTIONS-FAST?

Specify these Weatherhead

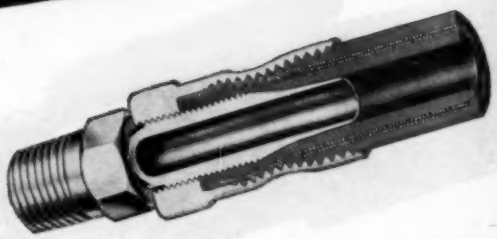
TIME-SAVING TWINS



ERMETO®

Saves up to 60% of installation time on steel tubing installations—up to 40% on copper and aluminum. You can make tube connections at all pressures with only a wrench—no special tools required.

Quick! Safe! Economical!



ALL-STEEL

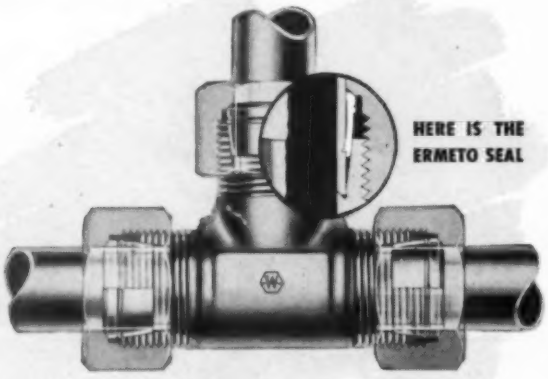
REUSABLE HOSE ENDS

AND INDUSTRIAL HOSE

Permit quick make-up of flexible lines from stock. Any length—whether low pressure or high—installation of hose assemblies with REUSABLE hose ends is quick and easy with ordinary bench tools.

Saves time—saves inventory.

HERE'S HOW ERMETO WORKS



No flaring, no threading, no welding, no soldering! Ermeto nut presses sleeve as threads engage. The forces acting on the sleeve cause it to bow slightly and actually bite into the surface of the tube. This strengthens the seal (see enlarged section, above), distributes vibration strains and holds a constant tension between the body and nut, to prevent loosening. Disassembly and retightening are easy—the sleeve remains in place, assuring a pressure-tight joint. Ermeto fittings meet J. I. C. requirements.

ASK FOR FULL INFORMATION

ERMETO—catalog No. E-1457A contains complete details on all sizes available in steel and stainless steel.

REUSABLE HOSE ENDS AND HOSE—catalog No. H-1451A lists complete range of hose sizes and pressures available for use in general industry.

Address: Dept. A, THE WEATHERHEAD COMPANY, 300 East 131st Street, Cleveland 8, Ohio. In Canada, THE WEATHERHEAD COMPANY OF CANADA, LTD., St. Thomas, Ont.

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FIRST IN HYDRAULIC CONNECTIONS